AMERICAN GAS JOURNAL

91st YEAR JUNE, 1949 VOL. 170 NO. 6

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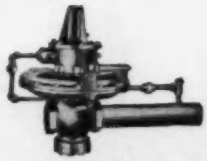
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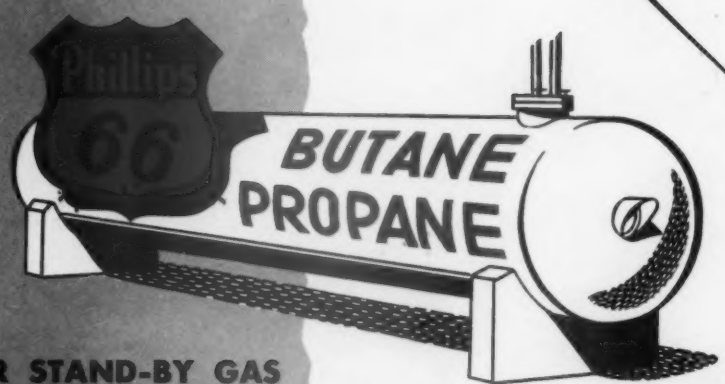

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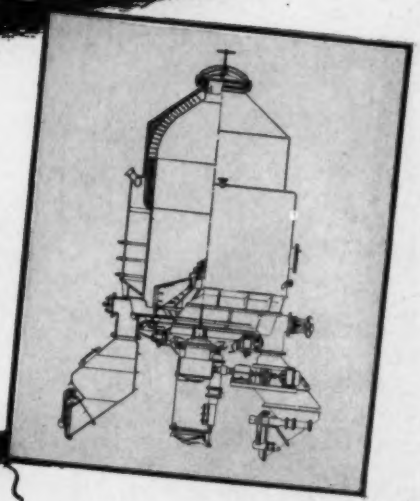
NEWS BULLETINS

4 More Semet-Solvay Reverse Flow Water Gas Machines placed in operation this year.

2 More under construction.

the 8th Semet-Solvay Mechanical Grate Generator placed in operation.

9th 10th 11th under construction



3 More Semet-Solvay Automatic Charging Machines now in operation.

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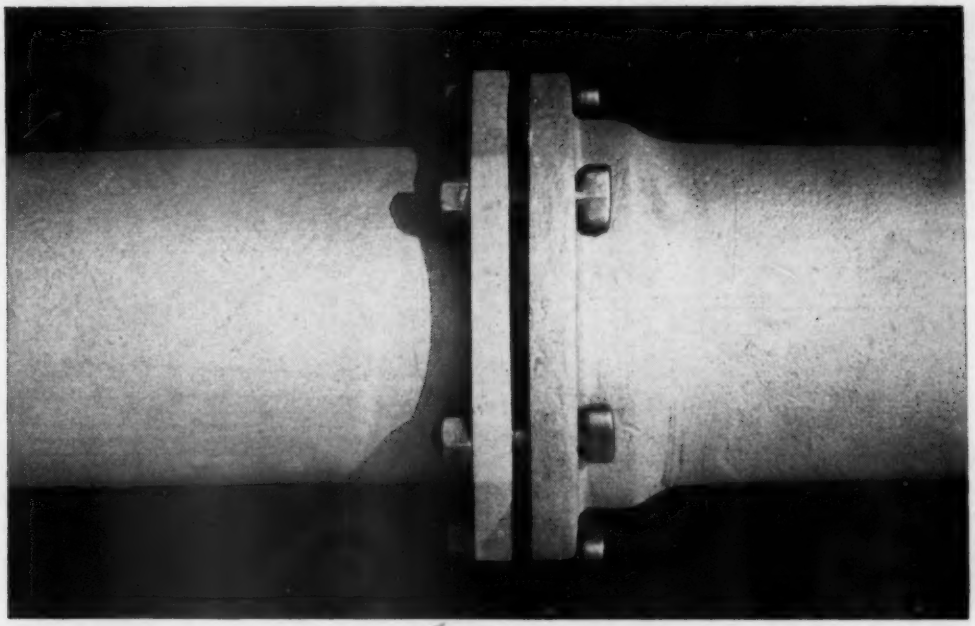
AMERICAN GAS JOURNAL, June, 1949. Vol. 170, No. 6 Published monthly by American Gas Journal, Inc., at 34 North Crystal St., East Stroudsburg, Pa., Executive and Editorial offices at 53 Park Place, New York 7, N. Y. Entered as second class matter October 7, 1928, at the post office at East Stroudsburg, Pa., under the Act of March 3, 1879. Printed in U.S.A.

Unretouched photograph of uncovered cast iron gas main installed 112 years ago in Boston, Mass., and still in service.

The vice-president of a middle western gas utility stated in a recently published article, and we quote, "Mechanical joint cast iron pipe is so much easier to lay—and so far as we have been able to ascertain, the joints are leak-proof." A prominent Michigan engineer recently referred to the long life of cast iron pipe as "An everlasting heritage for coming generations." Yes, with standardized mechanical joint cast iron pipe you get not only long-lived pipe and bottle-tight joints—you also get a saving in laying cost. More footage can be laid per day—with less delays in wet weather and less difficulty with wet trenches—and with lower labor cost. Is it any wonder that so many gas utilities have standardized on standardized mechanical joint cast iron pipe! Cast Iron Pipe Research Association, T. F. Wolfe, Engineer, Peoples Gas Bldg., Chicago 3, Illinois.



Many important gas utilities have standardized on standardized mechanical joint cast iron pipe for new mains carrying all types of gas at low, intermediate and high pressures. Now readily available in all sizes of pipe and fittings.

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This experience can mean money to you—dollars saved in initial construction, in uninterrupted trouble-free service, in minimum maintenance. Better get the full facts now; ask for Bulletin W-45. If you prefer, we'll be glad to present our story in person—and quote on your requirements. No obligation, of course.

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For an interesting illustrated 50 page catalog on Stacey Brothers Patented, All-Welded, Panel-Type Holders, write for Bulletin W-45.

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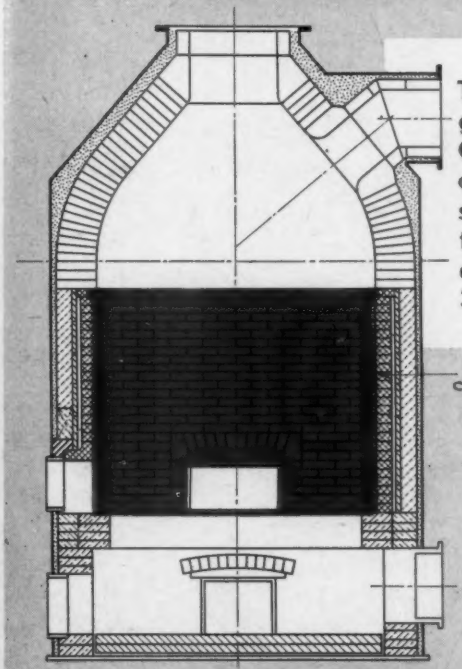
ALL-WELDED GAS HOLDERS

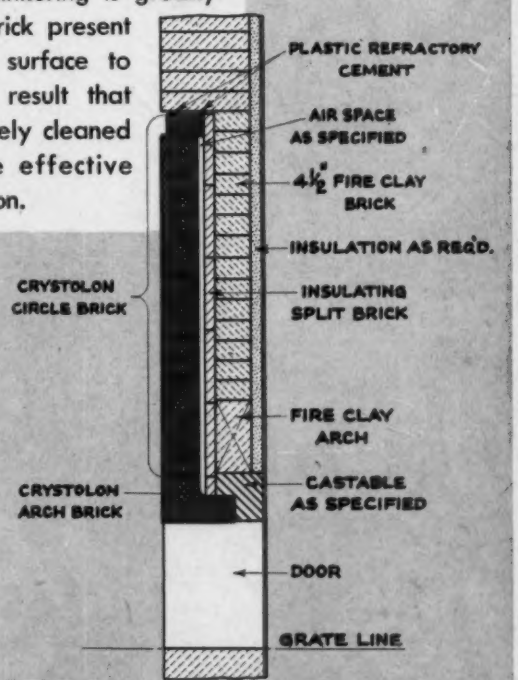
Generator lining pays for itself in One Year... when long-lived CRYSTOLON Brick are used...



Sectional drawing of gas generator lined with CRYSTOLON refractory shapes.

The most successful refractory for lining gas generators is silicon carbide which Norton Company manufactures under the trade-mark of CRYSTOLON. CRYSTOLON brick and shapes are helping many plant superintendents in three ways: 1. increased plant capacity; 2, decreased maintenance costs; 3. long lining life.

When CRYSTOLON brick are used "downtime" for clinkering is greatly reduced. These brick present an impenetrable surface to clinkers with the result that walls are completely cleaned leaving a large effective furnace cross-section.



Cross-section of gas generator wall showing details of refractories including CRYSTOLON interlining.

CRYSTOLON brick decrease maintenance cost by greatly extending periods between repair jobs and by reducing cleaning time. Because of the dense, hard surface of CRYSTOLON brick it is only necessary to break the clinker ring in one place and the entire ring will then fall free. CRYSTOLON linings often pay for themselves the first year by savings in cleaning costs alone.

The results which may be expected from the CRYSTOLON lining will vary with different operating conditions. In some cases, a total operating time of 8000 hours is considered satisfactory. Over 22000 hours have been attained without major repairs.

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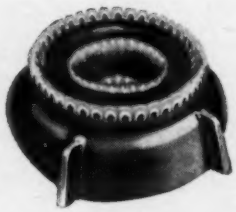

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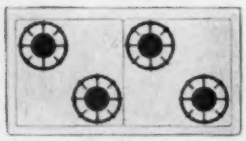

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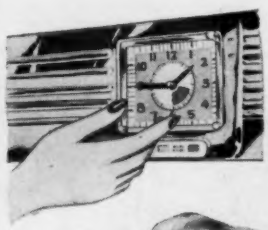

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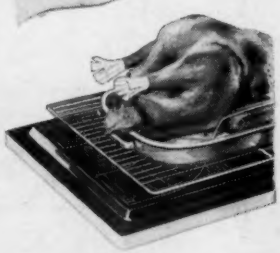

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SEALS OF APPROVAL

American GAS JOURNAL

VOLUME 170 JUNE 1949 NUMBER 6

This month . . .

Effective with this, the June 1949 issue, ownership of the AMERICAN GAS JOURNAL passes from the estate of the late Stanton G. Krake, to a new group of owners, composed of E. Holley Poe, Elliott Taylor and Lewis V. Hohl.

Almost inevitable when such a change is announced there is the temptation to capitalize on the curiosity created and to launch into gaudy promises and predictions of the future course that the publication will take.

In speaking of a magazine that has completed its ninetieth year of uninterrupted service to the American gas industry, any prophetic view of the future that seemed, even by implication, to deal casually with the accomplishments of the past would be in singularly bad taste.

It seems altogether fitting, also, as the publication passes into new hands, that those who will now guide its destinies pay just tribute to the memory of the man who was its editor and publisher over the last three decades,—Stanton G. Krake. His service to the gas industry has been well recorded in the work he performed. To acknowledge it here, must be at best an inadequate expression of the respect and regard with which his labors have enriched his memory.

The form and substance of the publication will inevitably yield to change, just as the nature and complexion of the gas industry have changed since the middle of the nineteenth century. New avenues of journalistic and industry interest will be explored; but never in disregard of the proven routes of the past. An expanding audience will be sought for; but not through the neglect of the loyal readers on whose fidelity the reputation of the AMERICAN GAS JOURNAL has been so solidly built.

The future accomplishments and achievements, of the AMERICAN GAS JOURNAL will be recorded not in terms of the prognostications of today, but rather in the printed record as it monthly unfolds. Even were we inclined to do otherwise, we could still do no more than rest our case on that continuing evidence.

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Elliott Taylor • Editor

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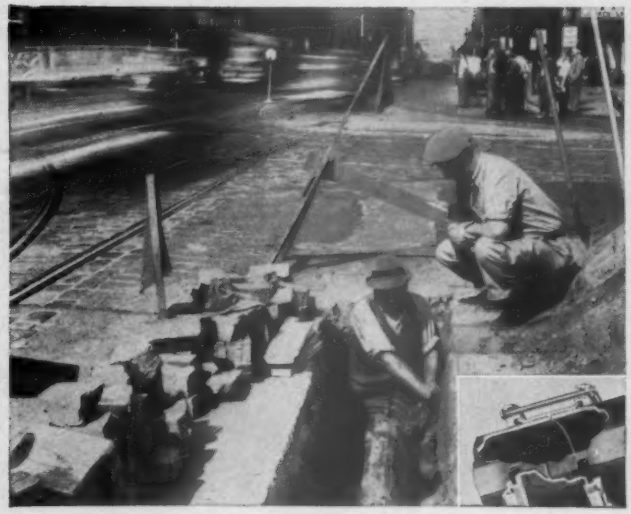

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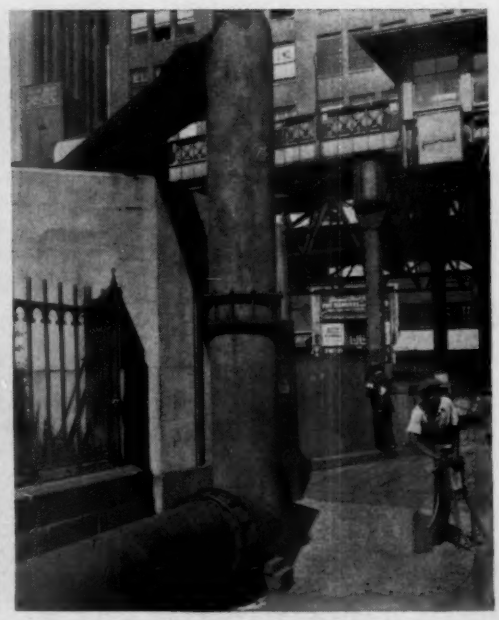

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Natural Gas Meeting Covers Problems of Vital Interest

By Staff Correspondent

NATURAL RESOURCES will be the first target of nationalization when and if the United States ever attempts to follow the socialistic pattern set up in Great Britain, in the opinion of William J. Murray Jr., chairman of the Railroad Commission of Texas, who addressed more than four hundred members of the Natural Gas Department of the American Gas Association at the opening of its annual spring meeting in French Lick Springs, May 9 and 10. He added that from his own observation: "There has been no country in which nationalization of natural resources has been tried that it has not failed."

Presiding over the two day session was D. A. Hulcy, chairman of the Natural Gas Department of AGA, who welcomed the delegates and introduced the speakers at the general sessions. The first speaker was R. W. Hendee, president of AGA, who bespoke continued intra-industry harmony and cooperation as exemplified by the coordinated promotion, advertising and research activities now being actively advanced under the PAR plan. "The common problem of all gas utilities today is to hold the basic cooking, house heating, refrigeration and water heating loads in the face of all-out competition from the electric industry," said President Hendee.

Arch N. Booth, general manager of the Chamber of Commerce of the United States, delivered a stirring speech warning his listeners against the trend in political and governmental circles to lead the nation further from its traditional concept of a capitalist economy into the regimentation of a near-socialistic state. He advised that only through intelligent and informed political action expressed in working and voting for the advocates of a free economy would the United States be able to reverse the trend toward socialism that is already so well advanced.

The progress that has been made in the conservation of natural gas and in the elimination of much of the flaring in fields where oil is produced in association with gas was outlined in detail by William J. Murray. He paid tribute to the voluntary cooperation between the oil and gas industries, and cautioned his audience that public opinion will force still more stringent laws to prevent waste if industry is not able to achieve the desired ends through voluntary self-regulation. A condensation of his paper will be found on page 15 of this issue of AMERICAN GAS JOURNAL.

Laws and Rulings

The trends of the past year in legal, legislative and regulatory laws and rulings were reviewed and summarized by Glenn W. Clark, President and general counsel of Cities Service Gas Company, Oklahoma City. Three rulings by the Federal Power Commission during the past year have demonstrated that private contract provisions of natural gas pipe line companies with their customers will not be permitted by the FPC to take precedent over its interpretation of their validity under the Natural Gas Act. The divided mind of the FPC was again indicated by its three-to-two decision directing the Kentucky West Virginia Gas Company to reduce rates. The commission rejected the company's contention that gas from company-owned wells should be allowed a fair field price as an operating expense.

In certificate proceedings involving institutional financing, the FPC indicated its growing inclination to require competitive bidding on bond issues, and to insist on a larger proportion of equity capital in the financing of companies under its jurisdiction. Mr. Clark said that Commissioner Olds had expressed the opinion that, while the Natural Gas Act does not give the commission jurisdiction over security issues, it

Part of audience at opening general session

L to R: C. H. M. Burnham, Panhandle Eastern Pipe Line Co., Kansas City, Mo.; Harry D. Hancock, Gas Advisers Inc., New York; Elmer F. Schmidt, Lone Star Gas Co., Dallas; Robert W. Hendee, Colorado Interstate Gas Co., Colorado Springs.

can exercise at least a measure of jurisdiction by incorporating its views as reasonable conditions in the public interest in certificate cases.

"Highlighting the march of events under state regulatory commissions" was the order of the State Corporation Commission of Kansas fixing a minimum price of eight cents per thousand to be paid for gas to producers in the Hugoton field.

The Missouri Public Service Commission, on December 22, 1948, abandoned its attempt to establish regulatory powers over interstate natural gas companies selling to industrial users within the state, confessing lack of jurisdiction under the Missouri statutes. In January, 1949, the Illinois Commerce Commission withdrew its attempt to establish similar jurisdiction over the Mississippi River Fuel Corporation within the boundaries of that state.

In closing, Mr. Clark observed that many disputed regulatory questions are now on appeal before the courts, and subsequent decisions may reverse the rulings now in effect. "If the future years are as prolific (as the past one) in producing legal, regulatory and legislative events," he said, "none of us will suffer from excessive boredom."

Peak Load Problems

Major subject of consideration at the Tuesday general session was a symposium on peak load problems, with Chairman Hulcy again presiding.

Edwin L. Hall, director of the AGA Testing Laboratories discussed catalytic reforming and thermal cracking. He said that the question of peak load supply had become "increasingly prominent and bothersome," and that the introduction of natural gas into manufactured gas areas did not improve load factors. There are two obvious answers, he said. First, to store natural gas for release as required, and, second, to manufacture the gas for peak purposes.

In general, Mr. Hall said, it is true that catalytic reforming plants tend to be low in capital cost and to use high priced materials with low labor costs. They produce no by-products and require a minimum of gas cleaning and handling equipment.

Thermal cracking plants tend to be higher in capital cost, he continued. Used for cracking oil they are also operated with low labor and material costs. Provisions must be made for cleaning and purifying the gas but the tar produced is potentially quite valuable.

Thermal cracking plants will tend to be used where there is a sustained need for peak load gas and where the savings in raw materials used will more than repay the higher investment costs. Thermal cracking plants will also be used by modifying existing water gas plants where they are available. Such plants can be used for the production of oil gas with a minimum of new investment.

In discussing a table giving the cost per MCF of producing 1000 Btu gas, Mr. Hall said:

"The table indicates that in existing plants gas can be produced for 30 to 50 cents per Mcf and it should be noted that this 30 cent cost is well below current quotations for natural gas in this region (New England). To my mind this is most encouraging in that with the return of oil prices to more normal levels, the technical phases of our business may tend to return to our control. I do not believe that anyone would dispute the fact that many governmental rules and regulations have been developed because the cost of natural gas was so much lower than the cost of other fuels. Supply and demand should regulate these markets and there is no record of any other type of regulation that has been successful over a long period. If we can produce manufactured gas at the ends of our pipe lines for about the same price as we can deliver natural gas, then we will have a strong argument for the value of either the natural or manufactured gas. We will be able to utilize natural gas pipe lines with the maximum load factor and therefore deliver the gas at the lowest possible cost. We will be able to utilize existing plants to augment the natural supply of natural gas and thereby better balance the facilities of both the natural and manufactured gas industries."

Underground Storage

Where the circumstances are favorable, the underground storage of natural gas is the most economical method of meeting peak load conditions, according to Max W. Ball, gas consultant of Washington, D. C. At-

L to R: R. G. Griswold, Electric Advisors Inc., New York; A. F. Bridge, Southern Counties Gas Co., Los Angeles; W. C. Beckjord, The Cincinnati Gas & Electric Co., Cincinnati; T. J. Strickler, The Gas Service Co., Kansas City.

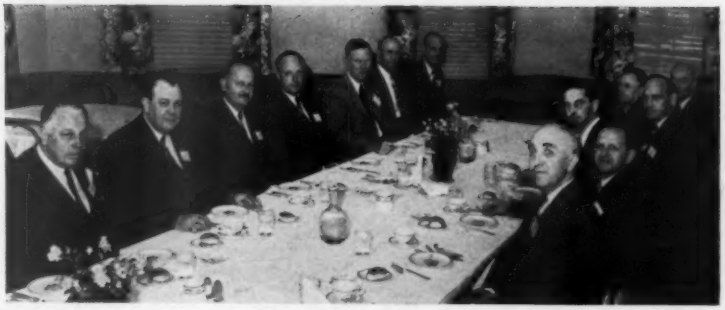
testing to the growing economic importance of underground storage, the speaker recalled that since 1919, when the first natural gas was returned to the ground for storage, 426 billion cubic feet have been put in and taken out for winter peak use. There are presently in use 80 storage fields of from 700 million to 59 billion cu. ft. capacity, and 14 additional fields are being prepared as storage reservoirs.

Investment costs for underground storage vary widely, from a low of two cents to as high as 53 cents per Mcf.

Pointing out that stored gas and interruptible gas sales are not interchangeable, Mr. Ball said: "In the climate of Grand Rapids, a storage of 28.5 per cent of annual deliveries will permit house heating sales of 72 per cent of total annual sales, permit all other sales to be made for high priced uses, and permit 100 per cent load factor. Without storage, selling the same volume of house heating gas, making no gas, and with interruptible sales of the volume that would be stored, if storage were in use, the pipe line capacity would have to be two and one-half times as great, and the load factor would be 48 per cent."

Citing actual instances in the experience of companies, he showed that companies have increased the load factors of their transmission lines by from 10 per cent to as high as 50 per cent. Storage also gives the producer the ability to operate producing fields at an optimum year-long rate and to continue to serve markets that would otherwise have to be abandoned because of inadequate supply.

There is an intangible public relations value to adequate storage, in that it makes dump gas sales unnecessary, and invalidates the arguments of those who decry the sale of gas for inferior uses. "And whether or not the sale of gas to burn under boilers is poor morals or poor public spirit, it is poor economics if you can get storage," he said.



Transmission Luncheon L to R around table: George Smith, Headquarters A.G.A.; D. A. Hulcy, Lone Star Gas Company, Dallas; F. A. Hough, Southern Counties Gas Co., Los Angeles; P. E Beckman, Pacific Gas & Electric Co.; Grove Lawrence, Southern California Gas Company, Los Angeles; J. T. Innis, Northern Natural Gas Company, Omaha; G. F. Brunston, Colorado Interstate Gas Co., Colorado Springs; E. A. Koenig, Texas Eastern Transmission Corp., Shreveport; D. C. Palm, Natural Gas Pipeline Co. of America, Chicago; C. S. Coates, Tennessee Gas Transmission Company, Houston; John W. Kelley, United Fuel Gas Co., Charleston, W. Va.; M. K. Hager, Panhandle Eastern Pipeline Company, Kansas City, Mo.; George P. Bunn, Phillips Petroleum Company, Bartlesville.

Capacities Needed

The speaker presented detailed studies of how much storage is required for a system, where it should be located, and the type of field best suited for the purpose. "If your system is small," Mr. Ball advised, "look for small capacity. It will cost you less for cushion gas, among other things. But if what you want is storage to give you a high annual load factor without dumping or making gas, look for enough capacity to do the job, whether in one field or several. A good rough figure for desirable capacity is 30 per cent of annual firm sales."

In conclusion he advised: "Don't make up your mind about storage until you have studied the economics of your situation. . . . If you find that it could better your economics, then go hunting for it and don't think that you have to stay within sight of your present nearby gas field."

Luncheon group includes: William R. Beardsley, Colorado Interstate Gas Co., Colorado Springs; F. G. Kerry, Spaco Inc., New York; P. V. Mullins, Bureau of Mines, Amarillo; H. J. Garson, Northern Natural Gas Co.; E. G. Hammerschmidt, Texoma Natural Gas Co., Fritch, Texas; A. F. Bridge, Southern Counties Gas Co., Los Angeles; C. L. Moore, El Paso Natural Gas Co., El Paso; George P. Bunn, Phillips Petroleum Co., Bartlesville; C. V. Spangler, J. F. Pritchard & Co., Pittsburgh; R. A. Cattell US Bureau of Mines, Washington; V. T. Bloomer, Institute of Gas Technology; C. R. Anderson, Air Products, Inc.

A pipe storage system for equating hourly peak loads, and to provide standby gas for emergencies, has economic advantages not present in any other method in the opinion of F. A. Hough, vice-president, Southern Counties Gas Co., Los Angeles. Collaborating with him were W. C. Mosteller and R. O. Randall, also of Southern Counties.

The authors listed studies of various types of gas holders. Discussing pipe batteries they said: "Pipe . . . can be purchased and fabricated into holders for a lower cost per ton installed than conventional type holders. These factors tending to reduce the cost of pipe holders are offset in part by higher compression costs in some cases. However. . . the installed cost of pipe holders and the necessary compressor equipment is less under most operating conditions than the cost of conventional type holders."

Graphs were presented showing the cost of storing gas in conventional tank type and low pressure holders. Analyzing the study that had been made of these costs, Mr. Hough said that: "In practically all cases and under all conditions stated in the report, pipe or bottle holders give lower annual costs than any of the holders of conventional type. In cases where holders are designed for standby service, pipe and bottle holders will give annual costs of less than a third of the annual costs resulting from the use of conventional type holders."

The authors of the paper concluded that pipe and bottle holders are well adapted to equate hourly loads, provide standby gas for emergencies and supply the difference between normal peak day and extreme peak day loads. Pipe type holders are not useful for equating seasonal loads, or as a source

of supply for protracted extreme peak periods.

The installed cost of pipe and bottle holders, with the necessary compressor equipment was found to vary from $49 per Mcf. to $93 per Mcf. of capacity, depending on operating conditions and the design code used. The difference between the annual costs of pipe holders and bottle holders is small. Capital costs and total annual costs of either pipe or bottle types are less than those costs for conventional holders.

Committee Meetings

In addition to the morning general sessions, there were parallel afternoon meetings of the Transmission Committee and the Accounting Committee of the association.

F. A. Hough, chairman, presided over the deliberations on gas transmission.

Of special interest to gas transmission engineers was a paper by T. R. Foster of Clark Bros. Company, Inc., on the use of centrifugal compressors in the field of high pressure gas pipelines. By means of photographs and diagrams, he explained the technical operating details of commercial installations either in operation or now being built.

H. O. Buoen, of the Oklahoma Natural Gas Company, displayed and explained the visual aids to indoctrination and employee training that are used by his company.

H. D. Hancock, of Gas Advisers, Inc., reported on progress on revision of the ASA-ASME code for pressure piping.

The flow efficiency of the California section of the Texas-Pacific pipeline was discussed by W. C. Mosteller, of the Southern Counties Gas Company, Los Angeles. The company had been interested in discovering whether in actual operation the line would show the flow efficiency that had been calculated when the line was designed. With a little more than one year's operating experience, Mr. Mosteller said, present indications are that the line is developing the capacity originally designed in it, with a slight margin to spare. Whereas the designed capacity was based on an assumption of 85 per cent efficiency, all of the determinations have fallen within the range of 83 to 88 per cent. It is too early in the life of the line to determine whether there will be a change in efficiency with age.

One entire afternoon was devoted by the transmission experts to a consideration of pipeline construction and the fabrication of high-yield strength pipe into gas lines.

F. E. Richardson, of Texas Eastern Transmission Corp., and A. P. Maradudin, of Standard Oil Co. of Calif., presented papers on related phases of this problem.

A panel discussion, with T. G. Strong, of Natural Gas Pipeline Company of America, as moderator, considered problems connected with the construction of high yield strength pipelines. Participating as panel members were: A. P. Maradudin, H. C. Price, of H. C. Price, of H. C. Price Company, Bartlesville, Okla., and W. A. Saylor, of Consolidated Western Steel Corporation, Los Angeles.

F. W. Peters, chairman of the Accounting Committee of the AGA, presided over the afternoon meeting of his group, and presented a report on a meeting of an association subcommittee on accounting for underground storage of natural gas.

One formal paper on the reduction of natural gas accounting costs was read by H. O. Buoen, of Oklahoma Natural Gas Company, Tulsa. The meeting closed with an open discussion of natural gas accounting problems.

Canniff Explains Need for Informative Advertising

The return of the buyers' market makes it imperative that individual businesses redouble their efforts to interpret their policies and economic situation through advertising to employees and residents of plant city communities, Robert J. Canniff, manager of advertising and sales promotion, Servel, Inc., Evansville, Indiana, said in a talk before a week-long seminar for business executives at Harding College, Searcy, Arkansas, which was held recently. The seminar was the second in a series of Freedom Forums sponsored jointly by the college and the Joint Committee of the Association of National Advertisers and American Association of Advertising Agencies on Improvement of Understanding of the Economic System.

"It is important that workers and others affected by business realize that the customer is boss and that the way to protect sales and jobs is by working together to give customers the best possible products at the lowest possible cost. Management can win invaluable good will also by telling what it is doing through national advertising and sales efforts to keep sales volume and consequently employment at the highest possible level," Mr. Canniff said.

"It is up to us in industry to place the facts about the workings of American corporations before employees and the public in our plant communities in an understandable and convincing fashion to build confidence among workers in business leadership. If we don't, no one else will. Yet the public's confidence in the future of our system will largely determine both the size of our potential markets and the climate in which business will operate in the years ahead."

"Advertising can play an indispensable role in promoting the sale of both the tangible wares and the social product of American business. Advertising offers unique advantages as a channel of communication through which business can interpret itself to the public. Management can determine what messages it needs to get across, translate them into terms of interest to the reader, channel the messages to the desired audience and, through reiteration and continuity, drive home the facts about its policies and activities."

"Such public and community relations advertising, we have found at Servel, is far more effective when it is continuous. People suspect those whom they hear from only in emergencies. But when month after month they are taken behind the scenes through advertising and given an understanding of how a business ticks, they are more likely to be sympathetic and interested at times when the company has a message of vital importance."

"Properly merchandised to employees through direct mail, bulletin board blow-ups, company publications, conference programs and other methods, such advertising can be a major force for developing high employe morale."

Natural Gas Problems in the Territory of Greatest Reserves

By

William J. Murray, Jr..

Chairman, Texas Railroad Commission

AS OF January 1, 1949, the State of Texas has in round figures 96 trillion cubic feet of recoverable gas reserves, out of a total of 174 trillion cubic feet in the nation. Thus, Texas has approximately 55 per cent of the nation's proven gas reserves. Of Texas' gas reserves, approximately 27 trillion feet, which is over 28 per cent of the total, are found either associated with or dissolved in crude petroleum. Texas is the state of largest reserves and any problems which affect the production of gas in Texas must have considerable significance to the gas industry of the nation; and secondly, since the gas reserves contained in our oil fields represent a very significant portion of the total reserves, the problem of gas produced incident to the production of oil is also of concern to the natural gas industry.

The nature of the gas reservoirs and the general problems of the industry in East Texas and the Texas Gulf Coast are very similar to those in Louisiana. Likewise, the character of reservoirs and problems in Oklahoma and Kansas are similar to those of the Texas Panhandle; and the reservoirs and problems of New Mexico are similar to those of West Texas. Each of these states keeps in close touch with the others, and each state generally profits by the successful or unsuccessful attempts of another state to solve its natural gas problems.

Therefore, we might be justified in anticipating that all five states will follow a reasonably similar pattern in the future with regard to natural gas developments; or at least that there will be a general similarity between these four states and the particular areas of Texas which bear the closest resemblance to them insofar as natural gas problems are concerned.

In these additional states, we add approximately 55 trillion cubic feet of recoverable reserves; and this territory then contains 87 per cent of the nation's reserves.

Problems receiving the most discussion at present are: price, restrictions on exports, uniform standards of measurement, regulations both federal and state, ratable take, and conservation.

Many producers argue that natural gas is grossly underpriced at the well head at the present time, and that this disparity in price prevents an active exploration and development program for natural gas reserves and renders many conservation projects economically unattractive. Some states have attempted to enter the field of price through legislation, and there are statutes fixing the minimum price for gas in some states. A bill has been introduced in the current session of the Texas Legislature, to provide for the fixing of a minimum price on natural gas, but it has not yet come up for legislative action.

Many citizens of Texas have felt a keen concern over the rapid increase in volume of gas exported from the state. They feel that the future economic welfare of the state will depend largely upon a continuation of the present industrial development program, and that this industrial development will largely depend upon the availability of natural gas for fuel and raw material. These concerned Texans argue for restriction on the export of natural gas on two grounds, one, to prevent industries needing gas supplies from obtaining these supplies through interstate pipe lines and consequently forcing them to locate in the producing area; and two, conserve the supplies of gas needed for industries already located within the state. In this respect, the State of Louisiana is most similar in industrial development to the Texas Gulf Coast; strong sentiment in favor of restriction of exports has developed there in the past.

The official policy of Louisiana of opposing gas exports appears to be relaxing at the present time, as is common knowledge within the industry. The House of Representatives in the State of Texas has recently passed a resolution instructing the Texas Railroad Commission to actively oppose any additional interstate pipe lines which would export gas from Texas. Action on this resolution is presently pending before the Texas Senate. So far as is known, no similar actions are pending in the other three states.

There has been considerable discussion in all of the gas states with regard to establishing a standard system of measurement through legislation.

A bill defining a standard cubic foot of gas and requiring it to be used as the basis of all measurements has been passed by the Texas House of Representatives and is presently pending before the Texas Senate. This measure has received the active support of the Texas Independent Petroleum Producers and Royalty Owners Association.

The regulations of state and federal authorities naturally impose problems upon the producers of natural gas. The entry of the Federal Power Commission into the field of regulation of production of natural gas has brought about considerable concern and is the subject of pending legislation before Congress. The regulations of the state bodies lie principally in the field of prevention of waste and the requiring of ratable take.

Conservation in the production of natural gas involves the prevention of both underground and aboveground waste. The prevention of underground loss of natural gas is not nearly so serious a problem as is the prevention of loss of recoverable oil underground. Whereas we are probably recovering on a national average less than one-third of the oil in place in our underground reservoirs, we normally attain a much higher percentage of recovery of natural gas can quickly be lost through disfor casing leaks, as vast quantities of gas can quickly be lost through discharge into water-bearing horizons if the string of pipe set into the gas-bearing horizon becomes ruptured at some shallower depth.

Presented at the Natural Gas Spring Meeting of the American Gas Association, French Lick, Indiana, May 9, 1949.

In gas reservoirs having an effective water drive, excessive rates of production from individual wells can cause water coning; but as a general rule, most gas wells can be produced at relatively high rates without serious injury.

Production Restrictions

In our rich condensate fields, loss can be occasioned by retrograde condensation of liquids as the reservoir pressure is reduced. These liquids adhere to the gas-bearing reservoir rock, and a considerable portion cannot be recovered. In such cases, it is sometimes necessary to require that the field be cycled for liquid content prior to production of gas for market purposes.

When we come to the matter of production of natural gas associated in underground reservoirs with crude petroleum, we enter a field of very serious underground waste. In many oil fields, the principal source of energy for displacing oil out of the reservoir pore space is natural gas; and if this source of energy is dissipated, no further recovery of oil is obtained regardless of how large a percent of the original reserves may still exist in the underground reservoir. Consequently, in order to prevent serious loss of oil, it is frequently necessary to place stringent restrictions upon the production of natural gas from the gas cap of an oil reservoir. Such restrictions have gradually evolved as a clearer understanding was obtained of the role of natural gas in the production of oil, and it is believed that we may safety predict more stringent restrictions in the future.

Such restrictions necessarily involve the property rights of those producers who owns gas reserves in the oil reservoir. It is felt that the public interest requires regulations which will obtain maximum oil recovery even though this involves infringement upon property rights, but it is hoped that a system will soon be evolved for adjusting equities so that even greater conservation will be attained than that which we are presently accomplishing and yet no property owner having oil or gas reserves will be deprived of his rights. Since approximately 28 per cent of the total reserves of gas in Texas are found associated with crude petroleum, the necessity of stringent restrictions on the production of gas from oil reservoirs needs to be understood and anticipated by the natural gas industry.

Flaring

The aboveground waste of gas through flaring has long been a serious conservation problem, but in recent years it has occasioned more public concern than formerly. In times past, atrocious wastage of gas from gas wells was permitted to take place. At one time, more than one billion cubic feet were flared daily from natural gas wells in one single field in Texas, and several other fields each flared in excess of one quarter billion feet of natural gas daily. Gradually, through legislation and regulation occasioned by realization of the inherent value of this gas, essentially all flaring from gas wells in Texas has been stopped. Most of the other gas producing states previously mentioned have passed through essentially the same cycle as has Texas.

Most of the gas presently being flared is produced incident to the production of crude oil. This casinghead gas, has been burned in flares throughout the history of the oil industry. While improved completion and production techniques have greatly reduced the average volume of gas produced with each barrel of oil, it is still generally impossible to produce a barrel of oil without producing at least the quantity of gas which is dissolved in the oil.

Gradually the petroleum and natural gas industries have come to recognize that it is feasible and profitable to gather, process, and market the gas which is produced with oil. A very remarkable program of utilizing casinghead gas is presently underway, and it has seen more rapid development since the war than at any other period in the history of the industry.

Casinghead Gas

The natural gas industry recognizes that conservation of gas is in the public interest. It is going to have to help pay for this gas conservation program, however, and the bill is going to be rather high. Casinghead gas is admittedly not as convenient to market as is gas from natural gas wells. It must be gathered in relatively small quantities from many producing oil wells. It is under low pressure and must be compressed. The production of casinghead gas cannot be increased or decreased to meet fluctuating market demands, but is geared to the production of oil.

I believe that in spite of the difficulties inherent in the marketing of casinghead gas, the pipe line companies who have gone to such efforts to furnish markets for flare gas will find that they have done a thing which is not only to the best interest of the general public but, in the long run, a very profitable measure for the companies themselves. Although our reserves of natural gas are exceedingly large, they are not limitless; and the marketing of gas formerly wasted means a longer life for the industry, and long life reserves are certainly necessary for pipe lines whose amortization period is in the range of twenty-five years.

I recognize the difficulties which the gas industry faces in furnishing a market for casinghead gas, and in having voluntarily cooperated with the oil producers in this enormous gas conservation program. Present trends indicate that through legislation and regulation the purchasers of natural gas would be required, if they were not already largely doing so voluntarily, to give first consideration to affording a market to casinghead gas which otherwise must be flared.

In an effort to expedite this gas conservation program, the Commission not many months ago ordered seventeen oil fields in the State of Texas to be shut down until they could stop wasting the gas which was being produced incident to the production of oil. The authority of the Railroad Commission to enter such orders was upheld in the State Supreme Court. . . .

As a petroleum engineer I have always been taught to consider as practical only those operations which yielded more revenue than they cost. I am naturally exceedingly anxious that every conservation measure be a profitable one. However, the court has apparently held that the fact that in a given field it might not be possible to conserve flare gas at a profit is no excuse for permitting a continuation of this waste. I believe in most cases it will be profitable for gas companies to take this gas. It is important to remember, also, that public opinion is beginning to consider waste intolerable. To the extent public opinion can make itself effective through legislation and regulation, it will probably require producers to offer for market and purchasers to accept for market casinghead gas which has hitherto been flared.

Texas is currently engaged in a series of hearings to determine the most efficient rate of production for each oil field in the State and, in connection with other reservoir and production data, we are asking the operators to tell us in each case how much casinghead gas is being flared.

A compilation of these data, field by field, will show the total quantity

of casinghead gas presently flared in Texas. We have not progressed far enough with these hearings to give the over-all picture for the state.

In 1945, the Gas Conservation Engineering Committee of Texas, estimated that a total of approximately one and one-half billion cubic feet of casinghead gas was being flared in the state. This flare volume represented approximately 57 per cent of the total quantity of casinghead gas produced.

Comparison of the quantity of gas flared at casinghead plants in March, 1945 and March of this year indicates the progress that has been made in conservation. In 1945, the quantity flared was in excess of three hundred million cubic feet per day; whereas in 1949, with a much greater total quantity of gas going to plants, the quantity flared is only forty-seven million cubic feet daily. . . .

Ratable Take

Another timely problem is that of ratable take between separate producers within a field and between various fields. For many years, there was relatively little proration of natural gas production by the Railroad Commission of Texas. As a result of the Consolidated v. Thompson decision of the United States Supreme Court, some attorneys expressed the opinion that the Commission was prohibited from restricting the production of any gas well to less than twenty-five per cent of its open flow potential, if such amount of gas could be produced without waste; and if a given producer was diligent enough to find markets for his gas, he was entitled to produce up to twenty-five per cent of his potential even though an offiset operator might have no market for his gas and, therefore, would suffer underground drainage. Many gas pipe line companies, however, adopted the policy of offering connections to all of the operators in a given field and would then distribute their take from all of the wells to which they were connected on some formula considered reasonable by them even in absence of any Railroad Commission proration order requiring such division of take.

In several gas fields, the operators came to the Commission and asked that an allocation formula be adopted and that gas proration schedule be issued. In most of these cases, the Commission issued such allocation orders based upon the request of the operators.

Recently, the Commission issued a proration order for the Panhandle Sweet Gas Field somewhat similar to the original proration order for the Panhandle Field which had been stricken down many years ago in the famous Supreme Court Consolidated vs. Thompson decision. It was assumed that changed conditions would justify the Commission in issuing this order. The order was attacked in court; and, although I make no attempt to interpret the court decisions, apparently the refusal of a three judge federal court and a district state court to grant an injunction restraining the Commission from enforcing this order would indicate that the Commission does have the authority and responsibiilty in all gas fields to require ratable take if necessary to prevent inequities.

Based upon present trends, I would predict that the evolution of gas proration will roughly parallel that which occurred in oil proration about fifteen years ago and that, eventually, we will arrive at the situation in which the total market for gas from the State of Texas will be divided among all of the gas fields in the state upon some reasonable basis and the market thus assigned to each field will be divided among the producing wells in the field on an equitable basis. First consideration, however, will likely be given to the casinghead gas which is available for market and allowables will not be assigned to gas wells until the casinghead gas, which would otherwise be flared, has been furnished a market.

I do not anticipate that the Commission or any other regulatory body will ever attempt to require a gas pipe line to offer a market for casinghead gas from a particular oil field or connect to any certain gas well. Essentially, the same procedure will likely be followed as is today followed in allocating market demand for oil. If certain wells in a given oil field are without pipe line connections, no pipe line is ordered to connect to them, but the Commission assumes this to be evidence that oil is being produced in excess of market demand, and cuts back on the allowable for the field until pipe line connections have been offered to the unconnected wells. Likewise, if an entire oil field is without a market, the Commission does not attempt to require any purchaser to take this oil, but considers this to be evidence that the state as a whole is producing in excess of market demand. Over-all cuts in allowables for the state generally result in markets being made available to the fields which have been without opportunities to sell their oil. Future developments may demonstrate that such a procedure is applicable to gas.

Michigan Consolidated Gas Co. Conducts House Heating School

An assured supply of natural gas will shortly be available to consumers in the Grand Rapids, Michigan area. Texas gas is to be piped to this district by the Michigan-Wisconsin Pipe Line Company.* Some time during 1950 the supply of natural gas for this area will be adequate, and space heating contracts will again be accepted by the Michigan Consolidated Gas Company.

It is anticipated that approximately 25,000 additional homes will want gas heat just as soon as the change over can be made.

A school of instruction is being conducted by the company for wholesalers, retailers and their employees. Three hundred gas dealers and workers are attending this school. A quarter of them attend each of the four classes held weekly at the Gas Company's engineering offices. The first six weeks are being devoted to service and installation of the gas heaters and in the last six weeks engineering and sales will be discussed. A group of four teachers are assigned to each class.

Announcement of the company's new policy was made by Glenn Hammond, superintendent of engineering for the company. "We aren't keeping any waiting lists for heaters, but the dealers are," said Hammond. "There are now 13,000 gas furnaces and space heaters in the greater Grand Rapids area and we think that number will be tripled within one year after an unlimited gas supply becomes available through the new pipe line. Back in 1936 when the company used to sell most of the heaters here at retail, without competition from dealers, we thought 3,000 a year was a big number," Hammond added.

"We're relinquishing the wholesale distribution of heaters to dealers in the area because we want to be concerned chiefly with safe and efficient operation of the gas system for the customers rather than where they buy gas equipment."

* See March issue of this Journal, page 11.

Underground Storage of A Propane-Air and Natural Gas Mixture

By
H. L. Fruechtenicht, General Supt. and John B. Simpson, Engineer
Michigan Gas Storage Company, Jackson, Michigan

THE Michigan Gas Storage Company, a subsidiary of Consumers Power Company and Panhandle Eastern Pipe Line Company, normally receives large quantities of gas from Panhandle for storage in its gas storage fields in Clare County, Michigan during the months from May to October inclusive. It also receives gas in lesser quantities in April and November and that not needed for the daily demand of its customer is stored also. During the months of January, February, March and December, a minimum of twenty-five million cu. ft. per day is received from Panhandle and the balance of the daily demand is taken from the storage fields. At the present time, the Consumers Power Company is the only customer of Michigan Gas Storage Company, and its daily demand from Storage Company in addition to its own supply from ten Michigan fields varies from twenty million cu. ft. per day in the summer to one hundred million cu. ft. per day in the winter. Michigan Gas Storage Company divides its year into two parts; namely, input cycle from April to November inclusive, and output cycle from January to March inclusive, and the month of December.

Early in 1948 it was estimated that twelve billion cu. ft. of gas had to be stored during the input cycle of 1948 in order to meet the requirements of Consumers Power Company during the 1948-49 winter season and to replace the cushion gas which had been withdrawn during the winter of 1947-48. Careful studies of the conditions in the storage fields showed that the fields should not be depleted below 375 Psig without inviting probable damage to the reservoir. However, in order that service would not be curtailed and industry shut down during the winter of 1947-48 as it had been in other areas throughout the country, the Michigan Gas Storage Company elected to continue full service to Consumers Power Company even though the pressure fell below 375 Psig. As a result, the cushion was depleted to 334 Psig.

In 1946 when it appeared that a natural gas shortage was inevitable, Consumers Power Company started restricting its markets by complete curtailment of new space-heating customers, and in September, 1947, all industrial customers were placed on a quota basis (use restricted to that consumed during previous twelve-month period), and both of these restrictions are still in effect as of March 31, 1949.

The shortage of steel made it impossible to enlarge the facilities of both Michigan Gas Storage Company and Panhandle Eastern Pipe Line Company in order that full contract amounts could be delivered to, and received by Michigan Gas Storage Company. The most optimistic view of the deliveries for storage expected during the 1948 input cycle revealed a probable shortage, in meeting the estimated market and cushion replacement requirements, in excess of one billion cu. ft.

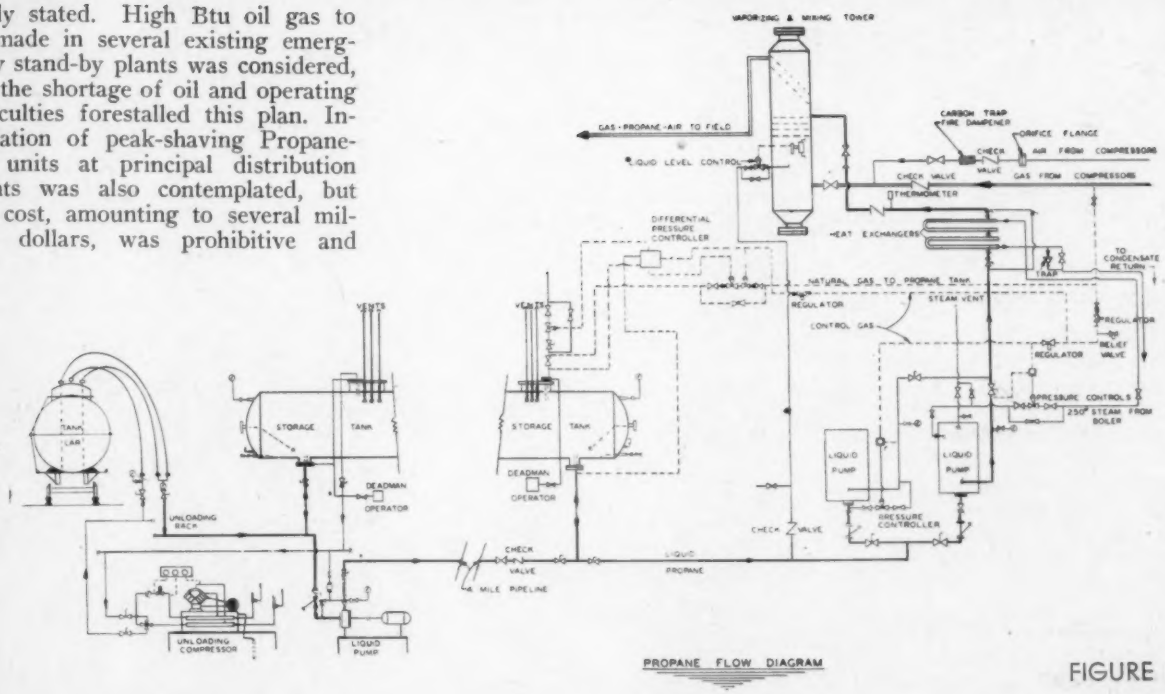
During the winter of 1947-48 when great demands were made upon the storage fields to avoid any curtailment of the restricted market served by Consumers Power Company, an increased amount of water was recorded in the wells of the storage fields. This water encroachment became greater as the pressure fell below 375 Psig. While some damage may have been done to the storage fields when they were operating from 375 pounds down to 334 Psig, the time the fields were operating at this lower pressure was of short duration. Any damage done is not believed at this time to be permanent.

Propane-Air as Adjunct

In order to meet this anticipated deficit, engineers of Michigan Gas Storage Company and Consumers Power Company studied various methods of obtaining additional gas. Sources of natural gas in Michigan were limited and no new discoveries had been made for several years, which made it impossible to secure additional local gas. Panhandle's capacity to make additional deliveries was found to be impossible at this time due to the material shortages al-

This general view of mixing station shows storage tank and pump house in foreground and compressor building in background with mixing tower to the left.

ready stated. High Btu oil gas to be made in several existing emergency stand-by plants was considered, but the shortage of oil and operating difficulties forestalled this plan. Installation of peak-shaving Propane-air units at principal distribution points was also contemplated, but the cost, amounting to several million dollars, was prohibitive and



PROPANE FLOW DIAGRAM

FIGURE 1

material shortages in this type of equipment were acute. There finally emerged from the above studies a plan to build one Propane-air plant at the storage fields, having a capacity of 10,000,000 CFD of Propane air, and mix Propane-air gas with large amounts of natural gas and store the mixture underground. The plant could be built for approximately $250,000 because part of the necessary equipment, (compressors, boilers and mixing tower), was installed and available for quick conversion. This plan offered continuous operation of the Propane-air plant and a uniform mixture immediately available for use when needed.

As far as could be determined, mixing Propane-air and natural gas for underground storage on such a large scale had never before been attempted, and some questions were raised as to recovery, vaporization, condensation, interchangeability and hydrate trouble to be encountered. Each of these factors was investigated, and the theoretical conclusions showed the plan to be workable. Further mention of these findings will appear in succeeding paragraphs.

Construction of Plant

Approval for construction was given June 3, 1948, and procurement of material and construction of the facilities started immediately. Construction included building a 1,600 ft. railroad spur, six unloading racks, and two steel buildings and installing three vapor compressors, two liquid transfer pumps, and one 30,000-gallon storage tank at the proposed unloading station. A four-mile four-inch pipe line together with a 4,800 volt, three phase power line and a private telephone line, was built to connect the unloading station with the mixing station.* The mixing station was incorporated with the natural gas compressor station injecting gas into the storage wells. A 30,000-gallon storage tank, two high-pressure liquid transfer pumps, a steam heat exchanger vaporizer, and one 800 hp Clark two-stage air compressor were installed. One 800 hp Ingersoll Rand single-stage gas compressor located in the main compressor building was converted to a third-stage air compressor. One of the gas compressor station dehydration contact towers was changed to a Propane-air-gas mixing tower, and the necessary steam and water connections were made. Air lines, aftercoolers, intercoolers, a carbon and fire arrester and other auxiliary equipment were installed to complete the mixing plant. This type of material was in short supply, and delivery promises tended to be much later than the con-

Unloading Rack with six unloading stations, one 30,000 gallon storage tank and 2 pump buildings.

ditions would allow. However, due to the emergency nature of the program, suppliers, contractors and employees cooperated to the utmost to complete the job on or before the deadline set as July 15, 1948, or a total of six weeks' working time. For a diagrammatic plan of this system, see Figure I.

Unloading Procedure

After the plant was completed and had settled into normal operation, six tank cars were unloaded at a time and the liquid pumped to the mixing station through the pipe line with the tank at each end acting as surge tanks and reservoirs to allow flexibility in the unloading operation and the pumping rate. The Propane in the storage tanks was used as a supply while the vapor was being removed from the tank cars and while tank cars were being switched to the siding or shuttled along the siding to the unloading points. At the mixing station the Propane was then pumped to a steam heat exchanger for vaporization and then to the mixing tower.

During the warm summer operation, the Propane was bypassed around the vaporizer as the heat of compression of the air and the natural gas furnished the heat for vaporization of the Propane. To vaporize 100,000 to 140,000 gallons of Propane per day from 70°F to 193° F at 540 PSIA requires from 75,000,000 to 106,000,000 btu per day. Natural gas in being compressed from an average suction pressure of 200 PSIG to a discharge pressure of 525 PSIG gave an actual discharge temperature of approximately 170° F without aftercooling. The specific heat of gas accounts for 24 Btu/Mcf/°F temperature change, and thus 40 to 60 million feet of gas in being cooled from 170° to the injection temperature of 70° F gave 95,000,000 to 144,000,000 Btu/Day available from gas compression. The third-stage air in being compressed from 90 to 475 PSIG had an actual discharge temperature of approximately 375° F and about 35,000,000 Btu/Day were available from air compression. When operations started, neither the natural gas nor air was aftercooled before mixing with the Propane. However, operation proved that vaporization, by passing this hot gas-air mixture through the Propane or the bubble trays in the mixing tower, did not follow the heat balance equations as the gas and air passing up through the liquid Propane had a considerable atomizing or mist action. It was found that an inlet temperature of air and natural gas of 90° F regulated by the amount of aftercooling was all that was required to give the 70° F temperature desired for injection into the wells.

TABLE 1
AVERAGE OF SPOT CHECK ANALYSES

	Natural Gas	Mixture To Fields	Mixture From Fields
	%	%	%
Nitrogen & Non-condensables	11.3	15.3	13.6
Oxygen	0.2	2.3	Trace
Methane	74.7	65.5	72.0
Ethane	13.7	5.8	6.6
Propane	—	10.9	7.0
Butane	—	0.1	0.6
Carbon Dioxide	0.1	0.1	0.2
Total	100.0	100.0	100.0

Compressor Equipment

Air was furnished by one two-stage Clark Brothers RA8 intercooled compressor taking six million cubic feet of air per day from atmospheric pressure and delivering the air at 90 PSIG to an after-cooler and then to one Ingersoll-Rand KVG 800 hp single-stage compressor. The third-stage air was discharged at the same pressure as the discharge pressure of the natural gas going into the storage fields. The air merged with the natural gas just before it entered the mixing tower and then the mixture of natural gas and air bubbled up through the liquid Propane. The resultant mixture of Propane-air-natural gas leaving the mixing tower entered the field gathering system and passed down through the wells into a sand reservoir lying approximately one-quarter of a mile below the earth's surface.

Properties of Mixture

The general properties of the mixture were as follows: from 100,000 to 140,000 gallons of Propane were mixed with 40 to 60 million cubic feet per day of dry natural gas of 0.685 gravity and 1,000 btu and then enough air was added to bring the mixture back to approximately the same btu content; namely, 1,000 btu. At the higher rates of Propane use, 140,000 gallons or more, the 1,000 btu standard could not be maintained, as the air compressor capacity was limited to 6,000,000 CFD. The pressure on the mixture varied from 400 PSIG to 525 PSIG in being compressed and stored in the field. The bottom hole or reservoir temperature was 60° F. The vapor pressure of the Propane at this temperature was approximately 92 PSIG. The Propane-air varied from approximately 15 to 25% of the total mixture and the Propane varied from 6% to 11%. Partial pressures due to the Propane varied from 31 PSIG to 58 PSIG and the Propane therefore never condensed either in the field lines or in the wells, and no liquid Propane has been found in the wells or gathering system drips to date. The averages of spot-check analyses of the natural gas and of the mixture to and from the storage fields are shown in Table 1.

A hydrate equilibrium curve as experienced for the straight natural gas and also for the normal Propane-air-natural gas mixture is shown as Figure 2. For straight natural gas at 540 PSIA the hydrate equilibrium point is shown on the curve A as approximately 49° F. and in normal operation little trouble is encountered except at the wellhead or wellhead drip where there are restrictions with their subsequent cooling effect. An insulated wellhead house and indirect heater counteracts this cooling effect by maintaining a uniform temperature. The hydrate equilibrium point for the normal Propane-air-natural gas mixture at 540 PSIA as shown on Curve B is approximately 56° F. Some hydrate trouble was expected with the storing of the mixture and consequently the wellhead temperature was maintained at or about 70° F. Out of a total of 293 storage wells some hydrate trouble was experienced in 37 wells. Temperature surveys in the wells revealed that a temperature of 49° F. was present at a depth between 600 and 700 feet and then rose gradually until it reached 60 to 62° F. at approximately 1,335 feet. In these 37 wells hydrate bridges formed anywhere between 150 feet and 700 feet below the surface in the well bore and effectively blocked the flow of gas. Neither the use of alcohol bottles nor the shutting in of the well removed the bridge and the only effective method found was to open the well to atmosphere and let it blow the

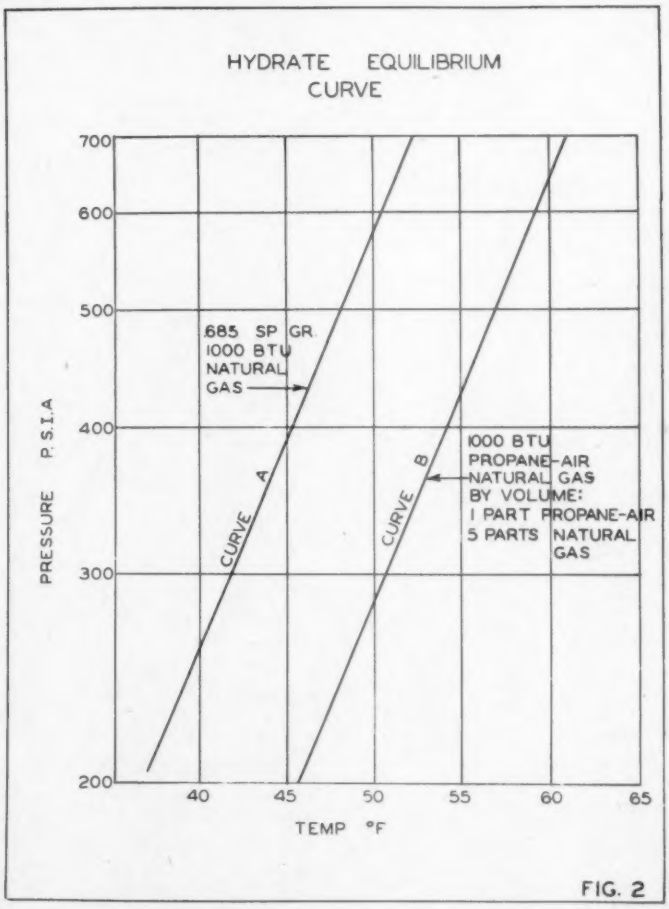


FIG. 2

hydrate bridge out. The hydrate bridges occurred more frequently when an insufficient amount of air was added to the mixture to maintain the 1,000 Btu heating value. By some experimentation and review of previous operating data, an upper limit of 1,030 Btu was set as the maximum allowable point and little hydrate trouble was experienced thereafter. The only control on the Btu range was the amount of air added to the mixture and it was limited to six million cubic feet per day. Some shipping delays necessitated a greater input of Propane than was originally planned and it was at these high input periods that trouble was experienced.

Difficulties Overcome

The high input rate of Propane occasioned by the shipping and switching delays also created another problem. At times as many as 18 cars a day were unloaded instead of the 12 cars originally planned and the time spent in removing the vapor from the cars became a limiting factor. During the hot weather the Propane vapor being pumped from the tank cars would not reliquify fast enough and the tank pressure would rise above 200 Psig, thus causing the relief valve to open. It was not possible nor feasible to install a refrigerating unit so a water spray was attached to the tank using the relatively cold ground water and this helped to reliquify the Propane to a marked degree. This speed of unloading and vapor trouble necessitated leaving many cars with 40 to 50 Psig of Propane vapor to go back to the shipper and increased the losses above those normally expected.

When the gathering system was installed in the field, it was not cleaned by the use of a "pig" but was only purged and blown. The high rates of reverse flow and the oxygen content of the Propane-air-gas mixture caused old scale to flake off and some new iron oxide to form and then fall off which was carried to the wells and in some instances had to be removed by blowing the wells.

With a compression ratio of 5.2 at times in the Ingersoll-Rand third-stage air compressor temperatures actually reached 375° F. or more. Excess oil in the compression cylinders formed particles of red hot carbon on the valves and deposited some oil in the air line. The carbon particles broke off and ignited the oil causing fire inside the air pipe line and raised the temperature of the air going to the mixing tower in excess of 450° F. Careful regulation of lubricating oil did not entirely remove this hazard so an aftercooler was installed and the air cooled to 100° F. A fire dampner and carbon arrester was originally installed just ahead of the air-gas mixing point to keep any fire from the gas and Propane. The total oxygen content of the mixture was 5% as a maximum and 17.7% was required to support combustion so no fire in the mixture was possible. The aftercooler installed at this time, together with the intercoolers originally installed, removed a considerable amount of water from the air and helped to reduce the quantity of water in the mixture stored in the field. It also offered another means of temperature control.

To keep the high pressure liquid Propane positive displacement pumps from vapor locking in the suction valve ports it was necessary to increase the suction head. A natural gas pressure of 10 to 40 Psig in excess of the vapor pressure of Propane was imposed upon the mixing station storage tank by means of a differential pressure controller.

Interchangeability

Interchangeability of the Propane-air-natural gas mixture with straight natural gas was calculated to be allowable at 7% of 1,000 Btu Propane-air in the mixture as shown in Figure 3. However, experimental testing indicated a higher allowable per cent mixture and it was believed that little trouble would be experienced with as much as 18% Propane-air in actual practice. It developed that approximately 21% of the mixture was Propane-air before trouble in utilization developed as experienced by trouble calls from customers.

Quantities Handled

From July 15 to November 1, 1948, a total of 1,194 cars containing 11,570,900 gallons of Propane were handled. Losses due to various causes amounted to 427,520 gallons, therefore 11,143,380 gallons of Propane were vaporized and mixed with 556,358,000 cubic feet of air to make 960,000,000 cubic feet of Propane-air gas with an average Btu of 1,060. This was mixed with 10,660,000,000 cubic feet of natural gas to give the resultant Propane-air-natural gas mixture a Btu value of approximately 1,007 and a specific gravity ranging from 0.720 to 0.790.

From December 13, 1948 to March

13, 1949, a total of 273 cars containing 2,783,920 gallons of Propane were handled. Losses due to various causes amounted to 16,275 gallons, therefore 2,767,645 gallons of Propane were vaporized and mixed with 210,822,000 cubic feet of air to make 310,990,000 cubic feet of Propane-air gas with an average Btu of 812. This was mixed with the Propane-air-natural gas mixture coming from the storage fields, and the resultant mixture transmitted to markets averaged 1,000 Btu. These two operations meant that most of the natural gas received from Panhandle during the summer for storage was enriched twice with Propane. During this second period the Propane-air percentage of the mixture transmitted to market at times rose as high as 22% at 1,000 Btu. At this percentage some trouble was experienced with reducing atmosphere process furnaces raw gas pilots, and a few home refrigerator burners; however, the number of service calls was not great in number and there were very few repeat calls. Higher gravities reduced the input to burners somewhat and in the case of space heating equipment failure to adjust for higher gravity resulted in slightly lower efficiencies. The mixture caused no other disturbances and was utilized all winter.

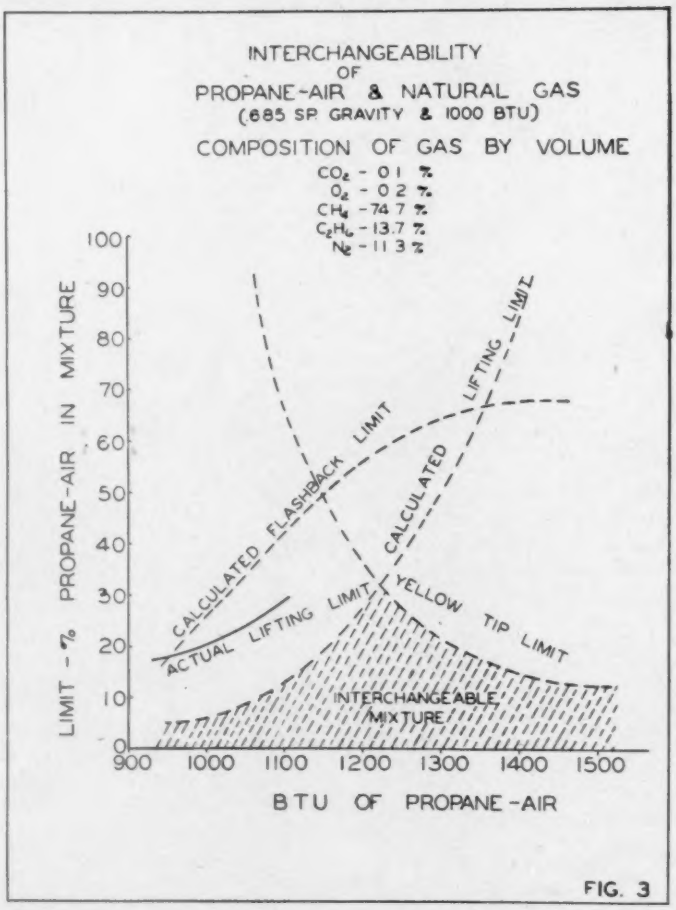


FIG. 3

Layout Changes

During the winter some modification in the plant layout was necessary for good operation during the cold weather which, at times, reached minus 20° F. The mixing tower was changed back to a dehydration contact tower to prevent hydrate trouble in the transmission system. The Propane was vaporized entirely by the steam heat exchanger and discharged into the suction of the gas compressors. No change was made in the air piping. During this type of operation the vaporization followed the heat balance equations perfectly, and it was necessary to temporarily install an oil field boiler to supply the necessary steam to the heat exchanger.

Composition Tests

During the output cycle, the composition of the gas was tested by Podbielniak analysis periodically and no really significant changes between the mixture put in storage and the mixture withdrawn from storage has been noted. The specific gravity of the gas coming from the storage fields has been a good index of the Propane-air-natural gas mixture being recovered. It is estimated that by the end of March, 1949 all of the Propane-air gas will be recovered from the fields except for a small amount which has diffused with the cushion gas.

The total cost of the Propane plant except for that material and equipment on hand and available for conversion and use was $252,000. The cost of the 14,354,820 gallons of Propane including freight to unloading station was $1,576,100. The operating labor, material and supplies and fixed charges amounted to $266,900. The total cost of the approximately 1,271,000,000 cubic feet of Propane-air gas was $1,843,000 or an average cost of $1.45 per thousand cubic feet.

Rate Increase Approved

The Michigan Public Service Commission approved the Propane project to prevent a gas shortage during the winter 1948-49 and issued an order allowing Consumers Power Company to add a surcharge to the bills of customers for all gas used in excess of 2,500 cubic feet per month in order to pay for the increased cost of this emergency gas. The surcharge amounted to 14½ cents per thousand cubic feet of gas above the previously stated minimum.

All evidence shows that this project was highly successful and as a result no customer was curtailed in his use of gas beyond the restrictions already in force. This amount of gas together with the milder weather experience during the past winter enabled the storage fields to go into the 1949 input cycle in a more improved condition than the previous year.

Presented at the Natural Gas Spring Meeting of the American Gas Association, French Lick, Indiana, May 9, 1949.

Lone Star Covers Tanks With Special Fabric

High resistance to weathering, including mildew and rot, has led Lone Star Gas Company, Dallas, to employ an aluminum-pigmented, vinyl-coated cloth woven of Fiberglas yarns for the covers of butane storage tanks.

Because customer storage tanks are exposed to all the extremes of summer and winter temperatures, they are wrapped with a one-inch-thick Fiberglas insulation blanket to protect the contents from below freezing temperatures and to reduce heat loss by radiation. The vinyl resin and Fiberglas fabric cover is placed over the insulation blanket to hold it in place and to keep it from being wetted by rain or snow.

Interfuel Competition

Is It to Be a Thing of the Past?

By
E. Holley Poe

THE time for indiscriminate panic-selling of natural gas is a thing of the past. Many things have combined to change the gas industry's outlook with respect to the value of the fuel it has to sell. The development of new products and processes in chemical technology has been a factor of ever increasing importance in bringing about this change.

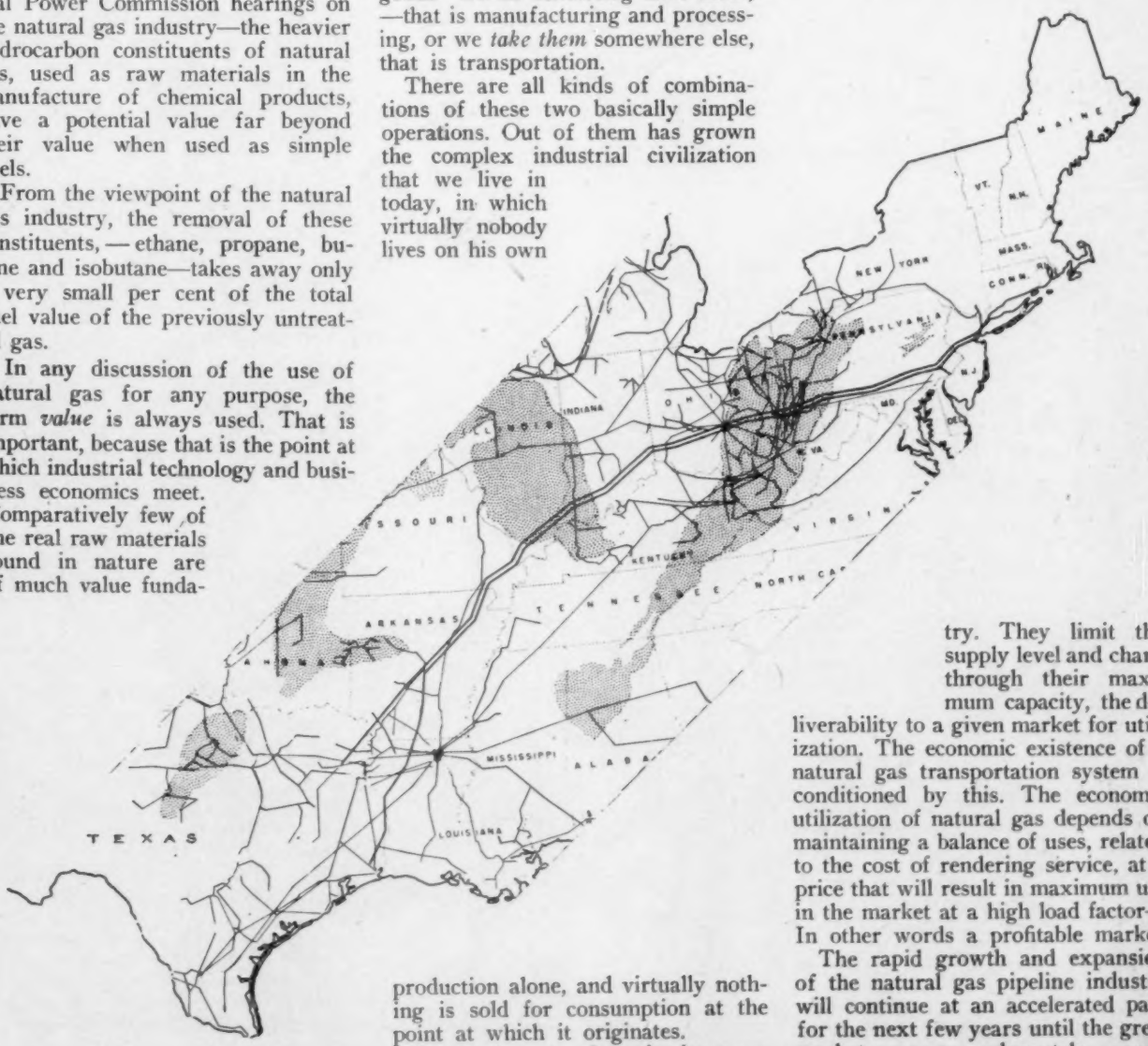
As Warren Watson, secretary of the Manufacturing Chemists Association, pointed out during the Federal Power Commission hearings on the natural gas industry—the heavier hydrocarbon constituents of natural gas, used as raw materials in the manufacture of chemical products, have a potential value far beyond their value when used as simple fuels.

From the viewpoint of the natural gas industry, the removal of these constituents, — ethane, propane, butane and isobutane—takes away only a very small per cent of the total fuel value of the previously untreated gas.

In any discussion of the use of natural gas for any purpose, the term *value* is always used. That is important, because that is the point at which industrial technology and business economics meet. Comparatively few of the real raw materials found in nature are of much value fundamentally just lying or growing or buried, as the case may be, where we find them. Nature is generous, it is true. But everything we get from her, we complex human beings have to do something about, or do something with before it means anything.

That is all that the economists mean when they tell us that the purpose of all production is consumption. In the main we do only two things with our raw materials to enhance their value as consumption goods—we do something *with* them, —that is manufacturing and processing, or we *take them* somewhere else, that is transportation.

There are all kinds of combinations of these two basically simple operations. Out of them has grown the complex industrial civilization that we live in today, in which virtually nobody lives on his own production alone, and virtually nothing is sold for consumption at the point at which it originates.



We in the natural gas business are still largely concerned with taking our product somewhere else—that is, transporting it to the most desirable market that can be reached at a cost compatible with sound economical operation.

The natural gas business, as we view it today, is essentially a transportation business because it is largely a well-to-market operation. Natural gas pipelines, still undergoing technological improvement, are highly specialized facilities in the overall function of the natural gas industry. They limit the supply level and chart, through their maximum capacity, the deliverability to a given market for utilization. The economic existence of a natural gas transportation system is conditioned by this. The economic utilization of natural gas depends on maintaining a balance of uses, related to the cost of rendering service, at a price that will result in maximum use in the market at a high load factor—In other words a profitable market.

The rapid growth and expansion of the natural gas pipeline industry will continue at an accelerated pace for the next few years until the great market areas are adequately served. There is a profitable market waiting

in New England that would justify a major pipeline from reserve sources in the Southwest into that area.

There appears also to be an economic need for a major pipeline into the Pacific Northwest from either the Province of Alberta or possibly the Rocky Mountain area where there are indications of large potential reserves.

Now it is obvious that when we are talking about a profitable market for any fuel we are introducing other and competitive elements into our considerations—for what a market will be able and willing to pay for a fuel depends on the use to which it is to be put, and the amount of competition that exists between the purveyors of that fuel and all of the possible substitutes that can be used.

The pipeline map of the nation that is shown here was a kind of tricky job, since we took for our basis a map not of the gas fields, but of the coal fields of the eastern United States.

They are the large shaded areas and represent the medium and high volatile bituminous fields. The lines are the natural gas pipelines.

Pipe Line Routes

Here is what appears at first glance to be some sort of an economic or business paradox, for the greatest concentration of gas lines per square mile is in areas that are marked as coal producing—and the greatest number of long distance high pressure natural gas transmission lines run from the gas producing fields in the southwest into, through, or near the coal areas.

While this does show how successfully gas has been able to go into the heart of the coal stronghold and compete for the market, the real significance bears out, in a prophetic way, the contention that eventually there will not be a competitive situation between gas and coal as such. For just as the big pools in the Texas Panhandle, the Gulf Coast, and other areas in Kansas, Oklahoma, Louisiana, Mississippi and Arkansas are regarded as the present major sources of gas supply, so one day the coal areas may become that source from which gas transmission and distribution systems will be filled.

In an article that appeared in *Fortune* magazine about two years ago the comment was made that: "Today we wrench coal from the earth by brute force. The basic operation of the coal industry is to shatter coal under ground, haul it to the mine mouth, sort it . . . dump it into barges or railroad cars in which it then floats or jogs erratically to its destination."

It may be that at one time the coal industry was complacent about its archaic operations but it is not that way today. The coal industry claims to have reserves in place of one and a half trillion tons—enough they say to last the United States for 3,000 years. But the coal industry is owned by people with capital invested in its salable output, and very few of them want to wait 3,000 years to realize on their investment.

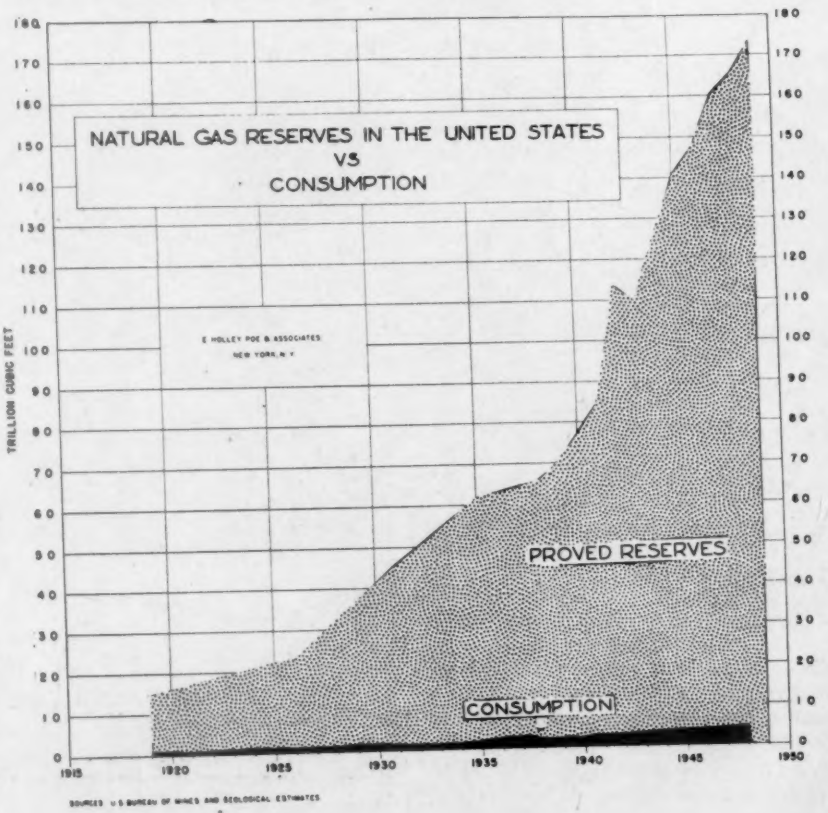
That is the simple principle reason why the coal industry is now cooperating so whole-heartedly in research aimed at getting it out of the primitive fuel class—and away from *Fortune's* picturesquely described "brute force" concept of its operations.

During the war the appalling drain on our oil resources stimulated a great deal of research and development in the synthetic processes by which oil could be made from coal. These experiments, which are even today out of the theoretical stage are still going ahead. Concurrent investigations are also being made in extracting oil from shale, and in making gasoline from natural gas.

All of this research in reality redounds to the benefit of the gas industry. For in making oil from coal, the manufacture of some form of gas is always an intermediate step. Whether that synthetic gas goes on through the process to become oil or gasoline, or whether it starts on its journey toward the point of utlimate consumption in the form of gas, then becomes a matter of economics, and the economics thus far supports gas manufacture only.

The second chart shows that in spite of all of the alarming predictions, natural gas reserves do not seem to be in any imminent danger of depletion. Every year that consumption has increased, as it has increased steadily for the past decade, the amount of reserves known to be in place and recoverable, has increased faster.

Eminent authorities have estimated that proved natural gas reserves of the nation are of the order of 170 to 180 trillion cubic feet or more. The new reserves discovered and not fully developed and the further extensions of existing large reserve areas justify us in considering, in my opinion, that the nation now has potentially available perhaps as much as 250 trillion cubic feet of natural gas to take care of market demands. This does not include any of the geologically favorable areas of undiscovered reserves nor does it include the off-shore potentials on the Gulf Coast of Texas and Louisiana. A number of competent geologists and petroleum authorities have indicated to me that there will possibly be more gas reserves in this area than have been



discovered on the Gulf Coast mainland.

So it looks as if there will be plenty of gas to use as gas, and plenty of gas from which to synthesize oil for many years to come, and certainly there will be coal enough for either or both uses to last indefinitely.

It all seems to me to add up to the fact that we are rapidly approaching the place where interfuel competition at the point of consumption will cease to exist. All of the gaseous or gas-making hydrocarbons will be regarded as raw materials, and which ever one is in the best strategic position to be used for any purpose or any market will be the one that will predominate. And in my opinion, when that day comes, the greatest flow of combustible fuel to any and all markets will be in the form of gas through pipelines.

With the new oil-gas processes now proved and available there is no reason why the pipeline and city gas distribution system should not supplant the familiar tank truck. If, and so long as, oil is the most economical stock to use for the purpose, it is not only possible but I believe economically feasible for us to build large petro-chemical gas plants on the seaboard, near large consuming centers, to produce large quantities of high Btu gas for distribution through the gas pipeline systems.

Of course, recognition must be given to the inevitable increase of price for natural gas at the source. It has always been cheap, but with the deeper drilling and greater demand, gas will and should be expected to increase in price.

Let us suppose that more or less coincident to such a development, the value of natural gas in Texas for raw material in a synthetic gasoline plant would be more than a gas transmission company could economically expect to pay for it, if it had to push it through two thousand miles of pipe to the New England market. Then you would have New England using *gas* made from *oil,* and you would have Texas producing *oil* or gasoline made from *gas,* and where would your inter-fuel competition be then?

Coal Field Gas

Now we will go a step further and say this. If gas can be made from coal in West Virginia and introduced into a pipeline there, at less than it now costs to bring gas to that point of introduction, then coal gas might well start moving through our present natural gas pipelines. There is no law of man or rule of physics that says gas can only flow in one direction from southwest to northeast. Then it would be only reasonable to assume that gas made in those shaded areas of coal, close to the mine mouth, would be flowing in either or both directions from its Eastern point of origin. It could and probably would move back toward the state of Texas to some hypothetical point on the line where the laid down cost of coal gas and natural gas were about even. Then where would there be any interfuel competition between gas and coal?

Of course some of these developments are further in the future than others. But this development on a national scale, which will inevitably come about, may be the stabilizing influencing that will work to the benefit of all of the fuel industries. It may be that one day we will see combustion energy going into the market in only two forms—as a liquid for internal combustion engines, and as a gas for all other commercial, industrial and residential uses.

This paper was presented at the meeting of the American Institute of Chemical Engineers, at Tulsa, Okla., on May 9, 1949.

Natural Gas to Reduce Fuel Cost for Con. Edison

Ralph H. Tapscott, Chairman of the board of trustees of Consolidated Edison Company of New York, told the company's stockholders at the regular annual meeting on May 16 that the bringing of natural gas to New York "will enable us to realize savings in fuel costs, and in addition to meet greater customer demands with little increased investment in manufacturing plant."

Mr. Tapscott pointed out that increases in gas rates has resulted in higher gas revenues in spite of lower sales.

"Despite increases in wages, these increased gas rates, plus a drop in the price of oil, will keep us out of the red, at least temporarily, in so far as the gas end of the business is concerned," he said.

Mr. Tapscott said that he saw definite signs of an improvement in the regulatory atmosphere all over the country.

"The utilities' number one problem," he continued, "is just as simple as this: to secure a rate of return sufficient to attract capital to the business, so that the industry may continue to supply the kind of service the customers have learned to expect."

Hahn Is Manager at Koven

L. O. Koven & Brother, Inc., Jersey City, N. J., have made Irving D. Hahn general manager of the recently acquired Koven plant, the D. W. Whitehead Co., in Trenton, N. J.

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This could be your Servel sales force . . .

if you had a salesmen's incentive plan!

The above illustration might be taken from a Gas Refrigerator sales manager's fondest dreams. What better way to beat the buyers' market than with a creative-selling-minded sales force ringing doorbell after doorbell! You can make it a reality with the help of an incentive plan that rewards salesmen who make house calls pay off in Servel sales. This plan will make canvassing more attractive and stimulate healthy competition among your men.

Have cards filled out on each prospect

Here's how you can work it. First, make sure your salesmen are equipped with survey cards that they can fill out on each prospect they find. Each card will contain space for name, address, current refrigerator data, date of call, etc. Printed cards have been found to be more satisfactory than blank cards. File these cards at your office at the end of each day's work.

Then when three sales, for example, are made to prospects for whom cards have been filed, the salesman who submitted the cards receives a cash bonus or a suitable gift. At the end of the month, the salesman responsible for the most "card sales" receives a larger award. As an added inducement, keep progress reports on each man posted on your bulletin board. No salesman likes to see his name last on the list.

Require that every salesman who makes a sale call back on his customer within ten days of the Gas Refrigerator delivery. Aside from checking to see if everything is satisfactory, the salesman is in a good position to interest the customer in other gas appliances. What's more, he should "use the user" for new sales leads. For detailed information on this and other buyers' market selling plans, write to Servel, Inc., Evansville 20, Indiana.

STAYS SILENT . . . LASTS LONGER

Servel

The GAS Refrigerator

Domestic Gas Water Heating

Chapter II—Water Heater Types

By
Charles W. Merriam, Jr., B.S.M.E.

THE PROBLEM of the moment is to get "First things first." Before diving into such subjects as how much hot water, what size heater, probable gas use, sensible installation, etc., the interests of logic would be served by first surveying the types of gas water heaters now available. In view of present market conditions, it is also well to include those heaters of the recent past that are now in common use. Although competitive fuels are an ever present factor (notably the furnace coil, the boiler "tankless," the pot belly, and the electric), the sales of units today are to a surprising extent replacements of worn out, obsolete gas automatics or of manual tank heaters.[1] In consequence, a salesman will do well to know the general characteristics of the common types of gas units encountered in the field. In fact, "the cash register would be hit more frequently," were the retail salesmen able to make a rough "back of envelope" sketch of each basic type and describe the general scheme of operation of each. To provide this necessary background material in a preliminary way is the purpose of this chapter.

The following tabulation summarizes the principal gas water heater types now in use for ordinary domestic purposes. (Those marked with * are illustrated herein.)

1. Side Arm
   a. Manual (sometimes called tank heater)*
   b. Automatic storage (now seldom sold)
2. Automatic Storage
   a. Outside flue (usually quick recovery)*
   b. Internal or center flue
      (1) Quick recovery
      (2) Medium recovery
   c. Convertible with internal flue (with provisions for so altering baffles and burners as to have a quick, a medium or slow recovery heater)*
   d. U-tube flue (slow recovery)
   e. Ball type of tank with internal flue (quick recovery)*
3. Instantaneous
   a. Manual for single faucet
   b. Automatic*
4. Conversion (for existing tank)
   a. Heat exchanger separate from tank
   b. Heat conducted through tank wall.

Of the above types, by far the most important in today's sales picture are the various types of automatic storage heaters, those with the internal flues seeming to be gaining in popularity.

Before progressing further, distinction should be made between the water heating unit and the water heating system. The water heating unit is designated here as the burner, the heat absorber, the storage tank (if any), the covering and all controls and equipment immediately attached thereto other than the incoming cold and outgoing hot water and gas lines that are separate and apart from the water heating unit. The water heating system is defined as including the foregoing water heating unit and also all of the attached hot and cold water lines, faucets, etc., in fact, the entire water heating system. Of necessity the water heating unit must be studied first as a unit that is only an integral part of the entire hot water system. Trusting that you have familiarized yourself completely with the general aspects of these five types of gas water heating units as depicted in the five illustrations with accompanying explanation, the following general discussion of the outstanding points of each is in order.

The Tank Heater, by virtue of its lowest first cost, is a temptation to which literally millions have succumbed. This type of gas heater is manually controlled, the quantity of water heated and/or its final temperature being dependent upon the length of time the burner is allowed to remain in operation. The galvanized (sometimes copper) storage tank to which the heater is attached is seldom insulated. Because heat is dissipated rapidly[2] through the uninsulated tank walls, the attempted storage of hot water for long periods of time in a bare tank is highly uneconomical. Due to manual control of the burner and also to the bare storage tank, the tank heater places a premium on the human factor to heat just the right amount of water at the right time. More frequently than not, a greater quantity of water is heated each time the burner is lighted than is actually used or needed, thereby resulting in a waste of gas. This fact is one of the principal reasons why the tank heater in the normal domestic installation consumes more gas per gallon of hot water used than the automatically controlled types.

The storage tank to which the tank heater is attached is commonly placed in the basement resulting in aggravating "stair scaling." Frequently installation is made in the kitchen, despite the unsightly appearance, over-

[1] In the past fifteen years, the installation of gas automatic water heaters has exceeded 10,000,000 units. It is variously estimated that the national saturation of gas automatics is between 45 and 55 per cent of the gas meters; however, saturation varies widely between cities and between regions. Such differences in saturation are caused by gas cost per million Btu, competitive fuels, percentage of owner occupied dwellings, percentage of apartment dwellers, income per capita, etc., but more particularly to the past and present selling and installation techniques.

[2] The U. S. Dept. of Commerce established under their Simplified Practice Recommendation R8-29 the following as standard diameters and lengths (inside in.) from which have been computed the approximate gallonage, and the heat (Btu) storage and loss at an 80°F. differential:

Dia.	Length	Gal.	Heat Stored at 80°F. Diff.	Surface, Sp. Ft.	Heat Loss Btu. per hr.[3]
12	36	18	12,000	11.0	1540
12	48	24	16,000	14.3	2002
12	60	30	20,000	17.5	2450
14	48	32	21,334	17.0	2380
14	60	40	26,667	20.8	2911
16	48	42	27,990	19.8	2772
16	60	52	34,667	23.9	3346
18	60	66	44,000	27.5	3850
20	60	82	54,667	31.0	4340
22	60	100	66,667	34.6	4839
24	60	120	80,000	38.3	5360
24	72	144	96,000	44.6	6240
24	96	192	128,000	57.1	7990

[3] The foregoing is based on 140 Btu. loss per hr. per sq. ft. of water tank surface, other temperature differentials being very nearly in direct proportion thereto. The 30 gal. is the most widely used size for domestic purposes.

heated summer kitchens and space consumption. The unhandiness of most tank heater installations often induces the housewife to employ her gas range for heating small quantities of water in a kettle, a subject previously discussed as "teapot" heating. Human nature being what it is, the tank heater does not lend itself to having ready the right amount at the right temperature at the right time—a distinctly "low readiness to serve" rating.

The thermal efficiency of the tank heater is dependent on, among other things, the effectiveness of the baffle and upon the extent of the copper coil surface exposed to the hot gases resulting from combustion. In practice coils range in length from 14 to 20 ft. and in diameter from ⅝ to 1 in. The longer the products of combustion stay in contact with the copper coils the greater will be the heat transferred into the water and, therefore, the less will be the heat losses escaping up the vent as evidenced by stack temperatures. Thus the length and size of the coils are important considerations. Certain "borax" houses and short-sighted plumbers, in order to slightly reduce the initial cost of the heater, which incidentally is a small part of the total installed cost, sell tank heaters with short length and reduced diameter coils of but "single" strength copper with the inevitable result of a dissatisfied gas customer. In attempting to offset the small hot water recovery capacity of these inferior tank heaters, the gas input is sometimes increased beyond the designed rating. A properly constructed tank heater can burn efficiently from 20,000 to 45,000 Btu.[4] per hr. depending upon the designed size, the ordinary being 20,000 Btu. (35.2 cu. ft. of manufactured gas).

At an assumed 65% thermal efficiency (a bit optimistic in practice), the ordinary tank heater will deliver at 80°F. temperature rise (8.33 Btu. being the heat absorbed in raising one gal. of water 1°F.) then 20,000 x $0.65 \div 8.33 \times 80 = 19.5$ gal. per hr. delivered into the tank. Then if 10 gal. of hot water are required for a bath

$$\frac{10 \times 60}{19.5} = 30.8 \text{ minutes, or}$$

the time required with the burner on full to heat the necessary water for one bath with an ordinary tank heater. This simple calculation disregards heat loss from the tank, mixing of hot and cold within the tank, as well as piping losses. Who can call this comfort and convenience—only the pot belly user or the "cold water hut."

An excessive amount of unburned gas striking on the coils can set up a carbon monoxide condition that makes for both danger and inefficient combustion. Because of this, also the possibility of a leaking gas cock, and to promote a cooler home, it is strongly recommended that all tank heaters be properly vented to a chimney.

The presence of copper coils in an intense temperature zone of long flames caused by a higher heat input than the design rating, accelerates the "liming up" of the tube interior, which becomes more rapid in proportion to the increase in water temperature. In time this interior crusting of the water coils acts as an effective insulator, thereby diminishing the thermal efficiency. Even under normal water conditions tank heater coils have a tendency towards restricted water flow due to lime and scale deposits. This difficulty is eliminated in some measure in the internally fired automatic storage heater because of the larger area of heat transfer.

Reasonably constant hot water temperature at the point of use is a characteristic inseparable from good service. Even with the most advantageous piping hook-up of a tank heater, (see diagram below from test data by the Cleveland Heater Co.) wide temperature fluctuations occur.

Observe in the foregoing that methods A and B provide a space in the tank below the point of water entrance into the attached heater, thus allowing for sediment accumulations and also aiding in keeping the coils cleaner. Note also that with methods B and C that the water line at the exit of the heater proceeds directly to the hot water line from the tank. By thus restricting the

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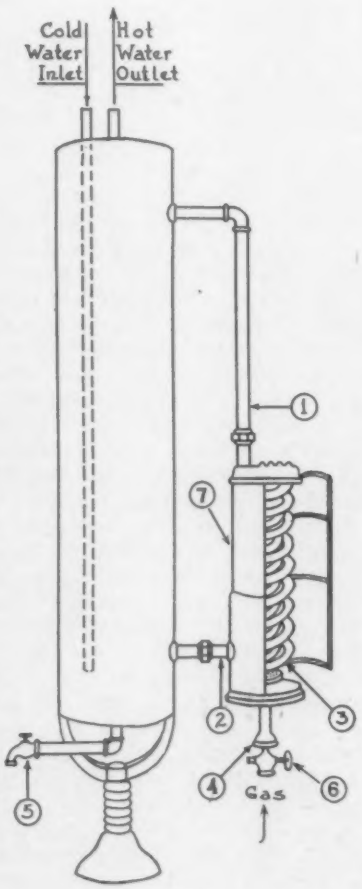
SIDE ARM (TANK) WATER HEATER

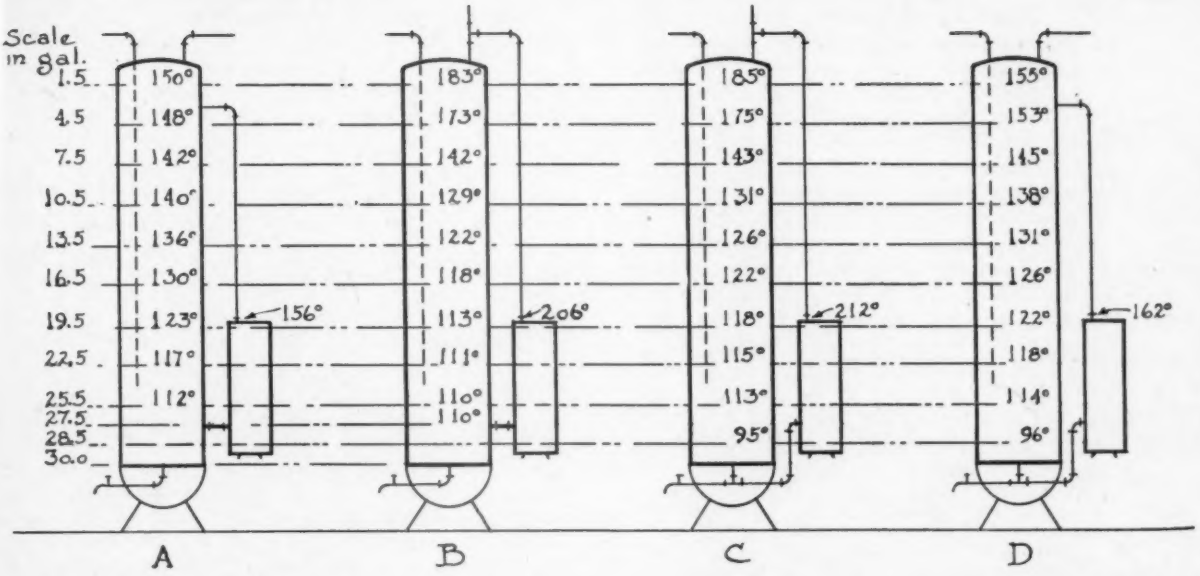
Gas is admitted at the point indicated, where its flow can be controlled manually by means of the gas cock (6). The proportion of air-gas mixture in the venturi (4) is adjustable by means of the usual spud and air shutter. When the gas cock (6) is turned on, a combustible mixture emerges from the burner at the bottom of the copper water coil (3). Ignition is supplied by a match. Combustion taking place, the flame and hot gases envelop the exterior of the water coils (3). The ascension of these hot gases is retarded by a spear shaped iron baffle (not shown in drawing) hanging downward on the inside center of the coil, thus increasing the length of time of contact. The coil, baffle and burner are enclosed in an exterior shell (7). The products of combustion are discharged at the top of the heater into a flue vent that is not shown here but which is strongly recommended.



Upon the application of heat the water in the interior of the coil (3) rises up through the hot water pipe connection (1) to be discharged into the uninsulated tank. Cold water flows naturally through (2) into the bottom of the coil (3). See accompanying drawing for other piping arrangements. Although tank is usually galvanized, it might be made of copper.

When water is withdrawn from the tank at hot water outlet, as shown, cold water is admitted at the connection shown. Cold water is carried by the inlet dip tube to the bottom to prevent dilution of hot water collected at top of tank. The drain valve (5) is for cleaning of the tank and also serves as convenience outlet for warm water after prolonged heating periods.

[4] The ordinary standard gas top burner on a range when on full burns roughly 9,000 Btu. per hr.; the giant burner 12,000 Btu. if properly adjusted.



flow of hot water, these methods result in temperatures approaching the steaming point. Obviously method A is recommended.

Now that we have appraised most of the faults of the tank heater, why the popularity? The tank water heater by supplying a relatively cheap means as to original cost furnishes a real need for hot water in the very low income brackets. The service afforded is cumbersome, intermittent and sometimes dangerous ,and substantially higher in gas cost per gal. of hot water delivered. The breadth of its acceptance is largely a matter of inadequate salesmanship at the retail level.

The Automatic Storage Heater (the outside flue, the center flue, and the ball tank type are illustrated) will supply hot water from the storage tank at a turn of the faucet at any time, day or night, up to the limits of its capacity, and at a temperature controlled by a so-called thermostat, thus relieving the owner of manually lighting and extinguishing the burner. This is characteristic of any automatic water heater, sometimes descriptively styled "self-action." Automatic heaters differ from the manually controlled type in that three distinguishing mechanical devices are always employed, namely the thermostat, the safety gas shut-off in conjunction with a pilot light, and the temperature-pressure relief valve, all of which will be described in a later chapter.

A storage water heater is classified by common acceptance as "quick recovery" when heat input is at the rate of 18,000 Btu. per hr. or greater. The majority of the quick recovery storage heaters in operation are between 20,000 and 35,000 Btu. input. Heaters with from 18,000 Btu. per hr. input down to 10,000 Btu. are commonly called medium recovery units, whereas units under 10,000 Btu. per hr. are generally classified as slow recovery.

In the Outside Flue Automatic type the heat first strikes the water tank at the bottom, which is usually concave in shape, forming a sort of combustion chamber with intense temperature. This is sometimes referred to as the "kettle" or "underfired" type. A large portion of the heat is transferred into the water through the bottom. Heat absorption continues through the side walls of the tank, chiefly at the lower levels where the water is cooler. That portion of the heat not absorbed in the unit is discharged at the top to the chimney. The latter heat, of course, is not converted to "useful work," and hence is wasted. The hot gases ascending along the side walls are enclosed by an insulated outer jacket acting as the outer wall of the flue. This outer flueway, in addition to aiding in keeping the products of combustion in contact with the side walls of the water tank, also serves to diminish the dissipation of heat into the room both when the burner is in operation (the heating up period) and when the thermostat has caused the gas to be turned off. Outside flue heaters are practically always of the quick recovery type.

When the main burner is cut off the constant burning pilot light, in addition to giving sufficient heat to keep the safety shut-off gas valve open also liberates a certain amount of heat into the combustion chamber and flueways. It is obvious that when the main burner is not in operation the direction of heat flow through the tank walls is reversed so that heat is discharged from the water in the tank back through the bottom, side wall and top thereby heating the surrounding air in the flue and hence passes up the chimney. Cooler air comes in at the bottom of the heater, around the burner and secondary air ports. Heat from the pilot light tempers this incoming air drawn in by the natural draft thus created. Some of the heat stored in the outer jacket and in the tank is conducted out through the insulation and outer wall jacket to escape into the room. The general process of heat dissipation is known as "standby loss," which is larger on the quick recovery storage heater than in the other two storage types illustrated.

The recovery capacity which, of course, refers to the speed with which a volume of water is elevated through some known temperature rise, is, in this type of heater, relatively quick, as the name indicates. A simple example is worked out here thus: Since 8.33 Btu. are required at 100% efficiency to raise 1 gal. 1°F. and assuming a thermal efficiency of the heater during the heating up to be 74% and the temperature rise to be 80°F., then for a heater having a 20,000 Btu. input hr.: $20{,}000 \times .74 \div 8.33 \times 80 = 22.2$ gal. or the approximate recovery capacity per hr.

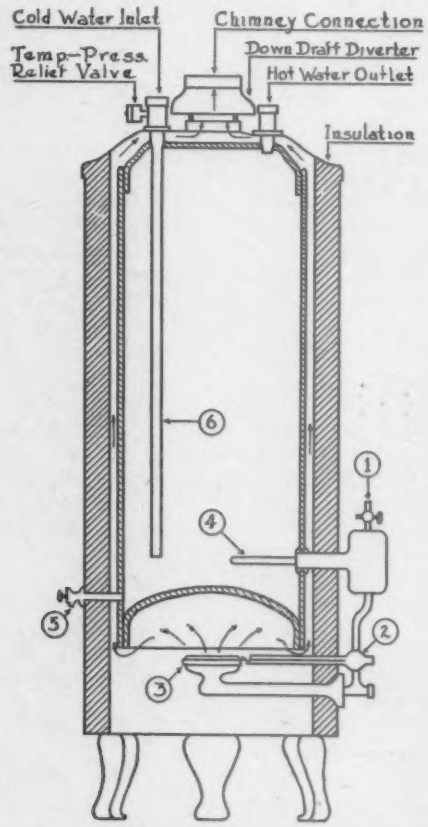
At this point it is significant to note that assuming the average withdrawal of hot water from the above heater to be 50 gal. in each 24 hr. period then $50 \div 22.22 = 2.27$ or roughly 2 hr. and 15 min. in each day is the time required for the burner to be in operation to heat up this amount of water. This is called the "heating up process." But to this must be added the burner time neces-

sary to offset the "standby losses."[5] In other words, for 2 hr. and 15 min. the burner will be consuming at the rate of 20,000 Btu. per hr. for the purpose of heating up the water to the temperature of the thermostat setting plus the heat added to the materials in the unit itself. This is not the total heat or gas required because during approximately 24 — 2.25 or 21.75 hr. the unit is wasting Btu. or equivalent gas into the flue and surrounding atmosphere, which is not useful to the purpose in view and is, therefore, a wastage that must be overcome by the supplying of additional gas heat. The outer flue types generally have a larger standby loss, size for size, but have the advantage of lower first cost.

[5] Standby losses at no withdrawals during an entire month will require from 20 to 65 cu. ft. of 525 Btu. per day (including pilot light input). The four chief factors governing this wastage in actual practice are: 1. design of heater, 2. water withdrawals, 3. effective draft from chimney and 4. temperature differential between water storage and the surrounding air.

AUTOMATIC STORAGE WATER HEATER OUTER FLUE

Gas connection is made at (1) where main gas shutoff cock is located. If water in tank is less than temperature of the thermostat (4) gas will travel automatically through body of same to main burner (3). When water reaches thermostat setting the gas valve turns off. Gas for constant burning pilot light (2) by-passes the thermostat valve, insuring ignition of combustible mixture at main burner heat (3) in the combustion chamber under the tank. Flame and hot gases transmit heat through the tank into water.



Products of combustion pass along the under and the side surfaces of tank in ascending the cylindrical passageway between tank and insulated outer walls, to reach the chimney connection, as shown.

If the pilot light is extinguished for any reason the automatic safety gas shut-off valve (2) becomes operative in closing off the gas supply to the main burner.

The temperature-pressure relief valve, as shown, automatically opens in event of failure of thermostat valve (4) to close when the water has reached a temperature dangerously above the thermostatic setting.

Water inlet is as shown conducting cold water to bottom of tank when hot water is withdrawn at outlet at top as shown. The drain (5) is for cleaning and an extra water tap.

The Convertible, Center Flue, Automatic Storage Heater is employed sometimes as a slow recovery unit, that is, from 4,500 to 9,000 Btu. per hr. input although the design is such as to permit alternations for a 20,000 Btu. heat input. This low gas demand gas burner and the center or internal flue with spiral baffling are essentially all that distinguish this type from the usual quick recovery.

The area of the center flue, being considerably less than that of the entire tank, does not expose as much surface for heat dissipation during standby periods as in the kettle (outer flue) type of quick recovery heater. This reduction in flue surface area runs up to 70% in some instances. By comparison, the center flue type consequently has lower "standby losses."

The spiral baffle in the center flue is for the purpose of retarding the flow of the hot gases by offering resistance to the natural upward draft, thus tending to offset the reduced surface available for heat transfer in the kettle type. This draft obstruction, or baffle, is so designed as to afford the proper draft to just carry off up the chimney the products of combustion of the rated gas input with a reasonable margin of safety. The engineers very aptly style this process increasing the sojourn of the hot gases, thus permitting transfer of the maximum possible amount of available heat to the water and, consequently, bringing about minimum stack temperature. These spiral baffles are built in segments so that lengths of the baffle may be removed as the heat, or gas, input is increased, thus creating proper draft conditions as the heater is converted from one recovery capacity to another.

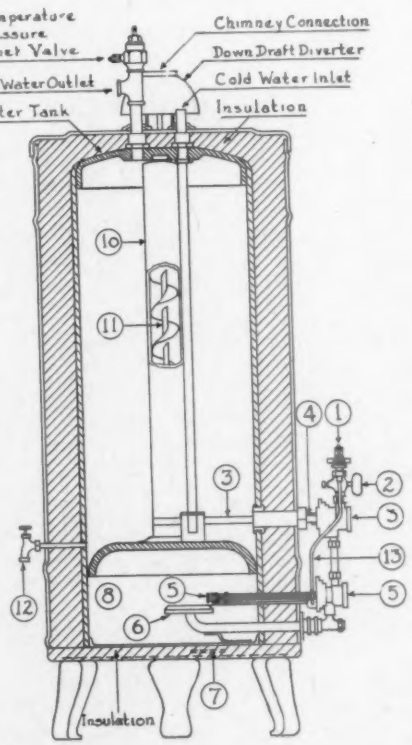
In connection with this center flue there is another thermal possibility worth mentioning; namely, that of insulating the water tank on top. The importance of this can be appreciated readily when it is considered that hot water rises upward and gathers at this point, thus insulating the top gives protection against heat loss at the most valuable location.

Observe in the drawing the insulation on the floor of the combustion chamber. This refinement contributes substantially to increased economies especially during periods of burner operation. In fact, this is a design feature adaptable to any type of automatic storage heater.

Low gas input implies a correspondingly low water recovery capacity and hence, compared with the quick recovery heater, imposes the necessity for a greater size of storage in order to meet large water requirements occurring during a short time interval. This relation of storage—recovery capacities to various hot water demand—is discussed later on. Assuming a heat input of 4,500 Btu. per hr. it is apparent (by the same process of reasoning employed in the calculations on the quick recovery type) the hot water recovery would be 5 gal. instead of 22.2 gal per hr. However, instead of the burner consuming gas for 2 hr. and 15 min. per day as on the quick recovery type, the burner time on the slow recovery would be 10 hr. This means that instead of 21.75 hr. standby the idle time would be only 24—10 or 14 hr., with the slow recovery type, thus substantially

AUTOMATIC STORAGE WATER HEATER CENTER FLUE, CONVERTIBLE

Gas connection is made at (1), where gas shutoff cock (2) is located. The flow of gas off or on to main burner (6) is controlled automatically by the thermostat (3) so as to maintain a nearly constant water temperature in the tank at the location shown. Gas for constant burning pilot under rod (5) is bypassed around thermostat (3) by tube (13), thus insuring ignition of gas-air mixture in combustion chamber (8).



Burned gas gives up most of heat to water through the bottom of tank, then ascends center flue tube (10) properly baffled (11) to chimney connection as shown.

By slipping in proper burning equipment (6) variable heat input may be had from 4,500 Btu. to 20,000, thus governing speed of water temperature recovery. The spiral baffle (11) is assembled in removable segments so that proper draft conditions may be obtained at variable heat inputs. The opening at (7) is for secondary air to support combustion at 20,000 Btu. rating.

If the pilot light is extinguished for any reason, the automatic safety gas shutoff valve at (5) closes off the gas supply to main burner. In event of failure of thermostat the temperature-pressure relief valve, as shown, becomes operative.

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reducing the length of time in which the standby losses are taking place. Offsetting in part this source of increased efficiency is the slightly greater radiation loss of the larger storage heater required to supply comparable hot water service. Engineers have a way of describing the situation by stating that, assuming the available storage plus recovery is adequate to meet peak demands, the improvement in the load factor (ratio of burner standby time) tends toward an increased overall economy with the slow recovery heater. The opinion is widely held by those companies having extensively used the slow and medium recovery types that sufficient overall fuel economies have been gained to more than offset the inherent added cost of larger units, and hence greater customer-satisfaction, provided discretion was employed in the selection of size so as not to render an unreasonably limited service. The convertible feature permits alteration in recovery capacity, when and if required, without disturbing the whole unit.

The currently sold **Ball Tank Automatic** is essentially a variation of the center flue, quick recovery type. The storage consists of a spherical instead of a cylindrical tank. Geometrically, a sphere will enclose 20 gal. of water with approximately 80% of the tank surface area required by a cylinder. The lesser surface area of the ball tank tends towards a reduction in standby loss.

The Automatic Instantaneous Heater is so designed that a sufficiently large volume of gas is burned under the copper coils to heat up the water to some predetermined maximum temperature, as such water travels through the coils to the faucet. Turning on the faucet starts the flow of water hence causing a drop in water pressure across the primary control valve which in turn automatically opens the main gas supply to the burners. Ignition is effected by a constant burning pilot, the heat from which is necessary to keep the safety shut-off valve open in the main gas supply line.

Gas inputs range from 87,000 Btu. per hr. to 350,000, depending upon the number of gal. water flow per min. specified (2.5 to 8 g.p.m. at 60°F. rise). From a distribution standpoint, gas demands of this character and magnitude tend to bring about pressure difficulties in both the service line and the mains. Large size meters are obligatory.

The elimination of hot water storage with this type of heater dispenses with the tank standby loss incident

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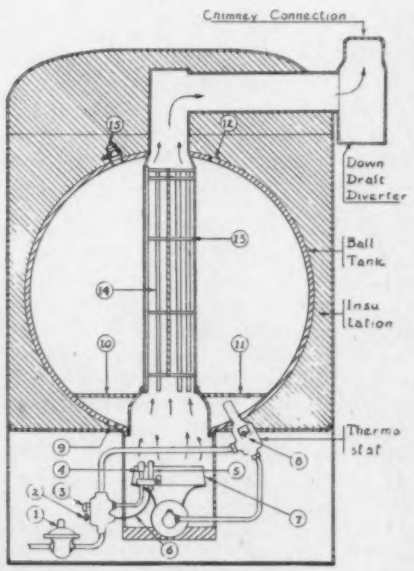
AUTOMATIC STORAGE WATER HEATER CENTER FLUE, BALL TYPE TANK

Gas enters through a pressure regulator (1). When the gas pilot (4) is lit, heat on the thermocouple (5) generates enough electricity to flow through the cable (6) to permit the safety shut-off valve (2) to pass gas through the manual cock (3) to the thermostat (8). If the water temperature is less than the thermostat setting, gas will flow to the main burner (7), ascending heat from which is baffled by discs (13) in the center flue. Vertical fins (14) assist in conducting heat to the flue walls and hence to the surrounding water.

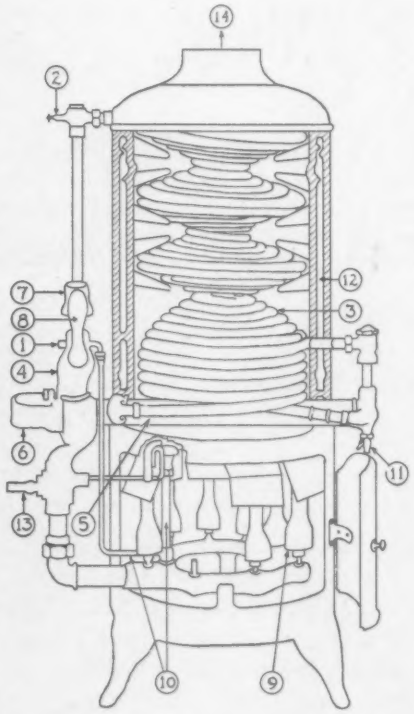


Cold water enters the copper tank at (10) on the underside of the "anti-turbulence" baffle in the vicinity of the hottest section of the center flue. Heated water progressing upward through a series of holes (11) accumulates at the top near the hot water outlet (12).

The temperature-pressure relief valve (15) automatically opens in event of failure of thermostat valve (8) to close when the water has reached a temperature dangerously above the thermostatic setting.

INSTANTANEOUS AUTOMATIC GAS WATER HEATER

The gas inlet is at (4) in the rear. The pilot light (10) gas tube bypasses the water-gas valve (6) and the safety gas shutoff (13), through which two valves the main gas supply travels to the burners (9). The manual gas shutoff cock is at (8).



Cold water is admitted at (7) and hot water is discharged at (1). The turning on of a hot water faucet causes enough drop in pressure across (6) to open, thereby permitting the main burners to come on and water to enter the helical coils at (2). The flow of water may be increased or retarded by the valve (2).

Water passing through the copper coils (3) absorbs sufficient heat to raise to the proper temperature. At point (5) is located an internal temperature regulating thermostat. Drain cock (11) is to facilitate cleaning of the water coils.

The hot gases pass up around the coils and to the downdraft diverter chimney connection at (14). The coils are surrounded by a dead air insulating chamber (12) and an iron outer shell jacket.

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to all other types of automatic heaters. However, tending to counter-balance this apparent saving there is the loss of the heat contained in the water remaining in the copper coil, in the metal of the coil itself and in the combustion chamber after the closing off of the burner. The tendency of these elements to cool is made rapid by being directly in the natural air draft caused by the chimney. As a very rough approximation (assuming 40 ft. of ½ copper pipe plus allowance for other materials and an 80°F. rise and a 75% heater efficiency), it is estimated that 1.7 cu. ft. of 525 Btu. gas is required to overcome the heat lost in each complete cooling of the heater back to room temperature. The loss of heat is not rapid enough probably to allow the heater to drop to room temperature each time the faucet is turned off. Nevertheless, assuming that in the normal home the water faucet is turned on an average of sixty times each day, the heat loss from this source approaches, if not exceeds, the standby loss of the normal domestic storage heater.

Perhaps the most difficult inherent design problem in perfecting the automatic instantaneous type has been in making the water-gas valve sufficiently sensitive to permit the closing of a faucet to immediately turn off the entire gas supply to the main burners. If this element of time lag after closing the faucet is appreciable, a considerable amount of gas is burned for no good purpose, a circumstance of particular importance because of the high rate of gas input.

The lack of flexibiilty of this type of heater introduces certain definite restrictions. Each size heater having some designed rating for maximum Btu. input, the maximum rate of water flow is fixed to supply a given number of hot water faucets, usually one or two. If any more than this prescribed number of water faucets are in use simultaneously a lowering of discharge water temperature results. If less than the prescribed number of faucets are in use a lowering in efficiency results. In a like manner fluctuations in inlet temperature introduce another variable factor.

The foregoing gives an inkling into the reasons in back of why the trend has been toward the use of the storage type. In addition to these several factors mitigating against the instantaneous type it should be observed that: 1.) the initial cost is high, 2.) a more complicated mechanism means increased service costs, 3.) replacement of heating coils due to burning out or clogging is expensive, 4.) relighting of pilot light with such large volumes of gas in the combustion chamber is dangerous to inexperienced operators.

Despite all of the above, it is generally recognized that for certain special applications the instantaneous has no superior and perhaps no equal. Consider for a moment churches and certain types of commercial establishments such as restaurants and other places where the water load is quite intermittent and where rather large amounts are used when required, or, in other words, applications where the faucets are not used frequently but where relatively large volumes of water are withdrawn each time that service is used. For these rare applications the absence of standby loss and the few number of "tailend" losses contribute to the instantaneous type being an excellent choice.[6]

In addition to the general types of automatic gas-fired water heaters illustrated and discussed in the foregoing, there are other types of heaters in use in the American market too numerous to much more than mention briefly here as follows:

A. The Side-Arm Automatic Storage Heater is, as the name implies, a thermostatically actuated tank heater connected to an insulated storage tank. This type has a pronounced tendency towards wide temperature variations within the storage tank. The thermal efficiency of the unit is comparatively low due to high heat losses from the heat exchanger caused by "reverse water circulation" during standby periods. In cellars in which spring and fall rains accumulate, the position of the heat exchanger considerably above the floor level is an advantage. The reduced overall height is advantageous in cellars with a low ceiling.

B. The U-Tube Automatic Storage Heater is constructed with a bent (180° angle), internally-fired flue pipe discharging the products of combustion downward at the base. In cold cellars some difficulty can be expected from flue condensation. This is normally of the slow recovery type and excellent results have been

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[6] It is significant to note in the "Final Report of Comparative Water Heater Tests" conducted by Massachusetts Institute of Technology at the behest of the Am. Gas Assoc. that the instantaneous type made a creditable showing. However, the draw-off schedule (pg. 19) indicates that the maximum number of withdrawals in the 50 gal. per day test totalled only ten which is far removed from ordinary home conditions. The method of conducting these tests, it would appear, did not exact from the instantaneous the full penalty of the frequent hot water tap use occurring in most American homes.

achieved with this heater which is widely sold in some areas.

C. The Automatic Tank Heater (sometimes called conversion type) during the late unlamented Depression became a considerable factor in the water heater business as a substitute for the sale of the conventional automatic storage type. The automatic tank heater is a device which installed on to an existing tank (range boiler or "what have you") converts the former facilities into an automatic gas-fired system. In jobs of this character the existing tank is, or at least should be, insulated by wrapping around it a specially prepared heat resisting jacket, usually sold in conjunction with the heater unit. Overall efficiencies with the better of these heaters approach that of the regular automatic storage type. The automatic tank heater has the distinct advantage of a lower first cost, the total installed cost approximating 65% of the regular type. However, the word "substitute" may be used advisedly because the customer still has a used tank, the heat loss from which is subject to the human equation to a certain extent, insofar as the application of the insulating jacket is concerned. The completed job is never more enduring than the existing tank. In territories where copper tanks are necessary the automatic tank heater gives promise of solving a heretofore knotty problem for low income groups. The reduced area of heat transfer from the combustion chamber to the surrounding water jacket subjects this conversion type to a reduced span of service years under adverse gas conditions (dirt, sulphur, or irregular pressures), flue, condensation, and to the prevalence of "hard" water in some areas. Low first cost has proved a substantial sales inducement despite the handicap of very low recovery capacity. Present sales are small.

The foregoing is essentially a "bird's eye view." Many of the particulars, such as tank materials, stratification, ability to deliver water at "useable temperatures" under prolonged withdrawals, relative thermal efficiencies, etc. are explored in greater detail later on. It is hoped that the foregoing will give a retail salesman a bit more than a "speaking acquaintance" with the tools at hand.

Gas-House Heating Progress Award

The American Gas Association has announced its third annual gas house heating award of one thousand dollars, in five prizes ranging from fifty dollars to five hundred dollars in cash, for activities deemed to have made the greatest contribution to the advance of gas home heating in the period of September 1, 1948 to September 1, 1949. These awards are sponsored by The Coroaire Heating Corporation, Cleveland, Ohio.

The awards will be presented at the A.G.A. Annual Convention to be held in Chicago, Ill., on October 17, 18, 19 and 20, 1949.

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GAS CONTROL SINCE 1892

The Price of Natural Gas in Competitive Fields

INTERSTATE carriers of gas steady the national market, but producers and distributors of gas "must have a real sense of its value in order to sell it properly and keep it in the proper competitive field," in the opinion of Gardiner Symonds, president of Tennessee Gas Transmission Company.

Mr. Symonds gave his views in a recent address before the Fourteenth Annual Meeting, Texas Group, Investment Bankers Association of America at the Shamrock Hotel in Houston.

"Gas prices," he said, "must rely on supply and demand because gas is a regulated fuel and prices cannot be increased "without long and expensive rate hearings, although costs are relatively inflexible."

He said oil and particularly coal are not regulated as to price, giving these two energy fuels a competitive advantage. He went on to say that although approximately 80 per cent of the Texas gas production is consumed locally, that the 20 per cent going into the interstate market has tended to stabilize the natural gas field price.

He broke down the overall operating costs of companies such as his own Tennessee Gas Transmission Company as follows:

Gas purchased or produced	24%
Labor	11%
All other transportation expenses	15%
Federal income tax	10%
Depreciation	12%
Capital costs	28%

Mr. Symonds said that he expected labor costs to remain relatively high, that income taxes are not likely to decrease, and that neither depreciation nor capital costs would be materially modified in the near future.

"That leaves the field price of gas to be considered," he said. "I have heard a great deal of talk about the rapidly increasing prices of gas—how this oil company or that oil company won't sell gas until it reaches a fuel equivalent; how the price of gas is going to increase greatly. Comparisons are often made on a fuel value basis with crude oil. The real comparison, if fuel values are to be considered, is with the price of fuel oil, not crude oil. The price of fuel oil is set by the same companies that set the prices of all other petroleum products—and they set them on the basis of supply and demand.

"Let's look at this question of supply. There is more gas proven and in sight today by fifty per cent than there is oil. To be specific, there is a thirty-year supply of gas in sight and only a twenty-year supply of crude oil, so certainly the pressure to take gas to market will continue. And, in their search for oil and gas, our oil companies, both majors and independents, have proved remarkably efficient at finding increased supplies. I believe their success will continue.

"I don't believe the field price of gas can be established by conversation. I believe that since more gas is being found every year than is being taken to market, sooner or later gas will have to be priced so that the market can absorb it. And in this connection, the market that must absorb the greatest part of the gas that is found in Texas is the Texas mar-

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ket. We have the greatest reserves of natural gas. Eighty per cent of the gas utiilzed is used locally; that is, in Texas, and hence only about twenty per cent of the gas produced in Texas, or for that matter in the Southwest, goes into the interstate market.

"The principal benefits of interstate pipe lines are that they have tended to stabilize the field price of natural gas and have given a Texas product a market which, although marginal in volume, is proving to be one which has provided a steadying influence on the industry in general. I believe that the price of gas in the field will rise, but that it will be a slow steady rise keyed to the broad growth of its major market, namely its local market, with whatever help expanding interstate carriers can give it.

"The price of fuel oil today is down to $1.35 in Houston, and certainly tanker charter rates are no more expensive, so that gas today in Eastern consumer markets is priced in direct competition with fuel oil. Consequently, if the price of gas in the field is to be talked up, gas will be priced out of these markets and fuel oil, which is now plentiful, will be the prevailing fuel.

"For basic comparative purposes, a barrel of fuel oil is the equivalent of 6,000 cubic feet of natural gas, and when prices are high, gas can be sold for boiler fuel and for other low grade uses. This condition builds up tremendous pressure for over-expansion of facilities and creates a market demand that seems insatiable. Let the price of fuel oil drop, and much of this market disappears, and stays with the low cost fuel which can deliver heat units most efficiently to the big industrial users.

"Regulation is primarily to protect the ultimate domestic consumer and the small user from excessive rates and to afford him the maximum of service. This cannot be done if gas is sold and facilities greatly expanded in good times *to take on markets that gas should not serve.* But a slow steady increase in the price of gas, a slow steady expansion to superior markets in new areas will mean a real benefit, not only to the owners of gas but also to the transporters and to the investment community.

"Gas must continue to be sold as a premium fuel and not as just so many Btu's. If *natural gas is sold on* a straight Btu basis, it must face fluctuating competition from *unregulated fuels.* The lack of appreciation of such a premium fuel can bring about unwarranted expansion and unsound contracts from the producer clear through to the ultimate consumer.

"The gas business is a great business and I believe that natural gas will develop into one of the great fuels on a nationwide scale, much more so than any of the advocates of competing fuels will now admit. I am also of the opinion that natural gas will supply a greater proportion of the superior uses than any of the producers and users of competing fuels will now concede. But care must be exercised in the expansion of natural gas markets."

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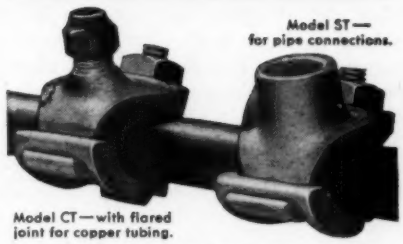

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Industrial Gas School Held at Indianapolis

THE 1949 A.G.A. Industrial Gas School was held in Indianapolis, Indiana during the week of May 9 at the Hotel Severin. Attending were 104 students from 24 states and the Dominion of Canada representing an excellent cross section of the gas industry. A breakdown of the school roll shows the following classification:

69 Gas companies.
19 Manufacturers of Industrial gas equipment.
7 Natural gas pipeline companies.
5 Service organizations.
4 Companies outside of the gas industry, but affiliated in one way or another.

104

Much interest and enthusiasm was exhibited by the students who were in constant attendance at the 24 lectures. A show of hands indicated that 75% had entered the gas industry since the war. Most of them were ex-service men who had recently completed their college training.

Two of the lecturers had themselves attended industrial gas schools; Rodney G. Hayler, Central Indiana Gas Co., Muncie was at the first school in New York City twenty-five years ago; and J. E. Coleman, Pittsburgh Group Companies had attended the second one in Chicago. Chairman for the Day, Nelson R. Gorsuch, Citizens Gas and Coke Utility, Indianapolis had attended the first Natural Gas Association meeting.

The men who presented the industrial gas course were well experienced in their respective fields and many were spokesmen for specialized phases of gas utilization. One outstanding example of this specialized knowledge was shown by Everett V. K. Schutt, Central Hudson Gas and Electric Corp., Newburg, N. Y., who gave the lecture on textiles and the various drying processes where gas heat facilitates production.

Two of the lecturers from outside the gas industry presented highly specialized technical subjects in detail. One was Dr. W. L. Sibbitt, associate professor, Heat Transfer Laboratory, Purdue University. He discussed heat transfer through furnace walls and the use of insulating materials. He stressed the point that heat transfer runs the gamut of physics, pointing out that the equations shown were analogous to Ohm's Law and that in many instances the values of insulating materials could be substituted for resistance. His address will serve as a useful reference work for the industrial gas engineer.

S. L. Case, Battelle Memorial Institute, Columbus, spoke on High Speed Gas Heating. He went into detail on the radiation values of ceramic gas burners. A comparison was made with induction heating, pointing out that high speed gas heating could treat certain shapes of materials in continuous processing just as rapidly and with equal metallurgical results.

Men from A.G.A. member companies constituted most of the faculty, including: J. E. Coleman, Pittsburgh Group Companies, Pittsburgh; P. W. Craig, Equitable Gas Co., Pittsburgh; C. C. Eeles, The Ohio Fuel Gas Co., Toledo; H. H. Gieselmann, The Laclede Gas Light Co., St. Louis; Rodney G. Hayler, Central Indiana Gas Co., Muncie; Stanton T. Olinger, The Cincinnati Gas & Electric Co., Cincinnati; F. T. Rainey, The Ohio Fuel Gas Co., Columbus; H. F. Rehfeldt, The Peoples Gas Light and Coke Co., Chicago; A. M. Thurston, The East Ohio Gas Co., Cleveland; O. O. Todd, The Columbia Gas System, Inc., Pittsburgh.

J. I. Cormany, The Gas Service Co., Kansas City, Mo. spoke on Practices and Trends in Converting Boilers to Gas Firing. He discussed relative boiler efficiencies on both straight gas firing and combination burners together with ways and means of using stand-by fuels.

Carl H. Lekberg, Northern Indiana Public Service Co., Hammond, was both a chairman for the day and an instructor. On his subject, Specialized Industrial Processes, he highlighted with personal experiences over the years.

D. A. Campbell, Bryant Industrial Division AGE., Inc., Cleveland spoke on Protective Equipment and Its Uses, pointing out to the students the difference between "safety" and "protection." O. E. Cullen, Surface Combustion Corp., Toledo, spoke on prepared atmospheres and W. A. Darrah, Continental Industrial Engineers, Inc., Chicago spoke of the fields of use for prepared atmospheres. Other instructors from manufacturing companies were: M. J. Dewey, Dewey Gas Furnace Co., Detroit; Raymond R. West, Brown Instruments Division, Minneapolis-Honeywell Regulator Co., and A. D. Wilcox, Eclipse Fuel Engineering Co., Rockford, Ill.

Bound copies of the complete set of lectures will be available shortly from the Industrial and Commercial Gas Section of A.G.A.

The Industrial Gas School in session. The 104 enrolled students came from 24 states and the Dominion of Canada.

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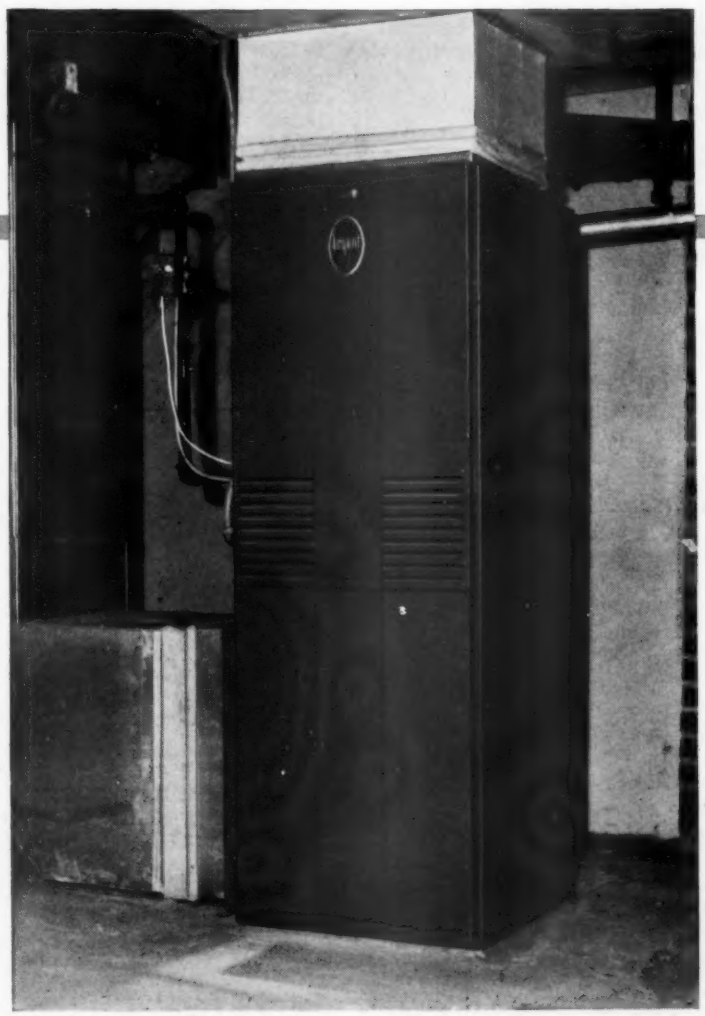

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Recent Court Decisions
Affecting Gas Utilities

Fair Labor Standards Act Affects Gas Industry

By
Leo T. Parker
Attorney at Law
Cincinnati, Ohio

ALTHOUGH gas company and municipal gas department officials have not in the past been particularly concerned with the Fair Labor Standards Act now is an opportune time to realize the full legal effect of this law. This is so because the Supreme Court of the United States has finally interpreted phases most importantly affecting the gas industry. Also, other higher court decisions clearly define rights and obligations under this United States Statute recently amended to increase minimum payments to employes.

Originally, many officials honestly believed that this Federal Wage Law affected *only* employes engaged exclusively and solely in interstate business and transactions. In other words, the ordinary layman realized only that corporations which transact interstate business are subject to the powerful and drastic provisions of this Fair Labor Standards Act. A majority of officials do not anticipate the far-reaching effect of this law, as recently interpreted by the higher courts.

First, let us state that the Fair Labor Standards Act clearly stipulates minimum wages that must be paid to employes engaged in "production, handling" and shipping of merchandise in interstate commerce. Hence, exactly the same minimum wages must be paid by gas corporations to employes who reside in rural districts as must be paid to city employes who of course have considerably more expenses, loss of time through transportation to and from work, and a multitude of other inconveniences and expenses compared to a rural employe whose living expenses are relatively low.

Validity of Contracts

Considerable discussion has arisen from time to time over the legal question: May gas corporations make employment contracts with employes which avoid responsibilities of the Fair Labor Standards Act? The answer to this question, taken from a multitude of late higher court decisions, is: No employment contract is valid by the terms of which an employe agrees to waive fully or partly the legal effect of the Fair Labor Standards Act.

See Welles, 15 So. (2d) 720, where the higher court held a contract between an employer, engaged in interstate commerce, and a bookkeeper *void* under which the employe agreed to work for less than wages specified by the Fair Labor Standards Act.

This court held the bookkeeper entitled to recover $2,200 back wages, attorney fees, and penalties.

The court held that although the employe signed a contract agreeing not to hold his employer liable for more than $30 a week salary this fact did not prevent the employe from suing and recovering *full* back wages due, penalties, and attorney fees under the Fair Labor Standards Act.

For comparison, see Malloy v. United of America, 16 Ohio Supp. 76. Here the legal question presented the court was whether employers must pay interstate employes wages for a minimum 40 hours each week. This court said:

"There is nothing in the Fair Labor Standards Act requiring a guaranteed weekly wage for a specified number of hours."

Hence a contract of employment is valid and does *not* violate the Fair Labor Standards Act which specifies a wage of *not* less than the legal minimum per hour, although the number of hours employment given the employe is fewer than 40 hours per week. In other words, an employe may be employed for one hour up to forty hours a week at a minimum wage of 40 cents per hour, under the old law. (Congress now is passing a new law.)

Exempt Employes

Certain employes are entirely exempt from the Fair Labor Standards Act. That is certain. For example, all officials and executives are exempt from this Act. Also, employes, as truck drivers, controlled by the Interstate Commerce Commission are exempt.

In Guthrie v. Emmons, 12 Ohio Supp. 45, Ohio, it was shown that the driver of a motor truck hauled products in interstate commerce. In other words, he transported merchandise from one state into other states. He sued his employer to recover wages for overtime, liquidated damages and attorney's fee under the provisions of the National Fair Labor Standards Act.

The higher court held the employer not liable, because the Interstate Commerce Commission *had the power to fix* hours of service of this truck driver. Under such circumstances the Fair Labor Standards Act is not applicable, so held this higher court. Other higher courts have upheld this law.

For comparison, see Farris v. Same, 12 Ohio Supp. 46, Ohio. Here a higher court held that a truck driver is entitled to wages specified by the Fair Labor Standards Act if such driver operates a motor truck *wholly* within the state, but *transports merchandise* that has been shipped to a depot from outside the state.

This higher court explained that this driver transported products *intrastate* since he hauled goods exclusively in a *single* state and, therefore, he was *not* within jurisdiction of the Interstate Commerce Commission, but he completed the *final* act of delivering merchandise shipped *in interstate commerce* and for this

reason he is within provisions of the Fair Labor Standards Act.

Hence, if an ordinary employe does "any" interstate work, he must be paid wages specified by the Fair Labor Standards Act.

See Southern California v. McKeown, 148 Fed. (2d) 890, where only 7 per cent of an employe's time was spent doing such interstate commerce work as checking invoices, freight and bills of lading for his employer.

The higher court held that this employe is entitled to be paid wages specified by the Fair Labor Standards Act, and said:

"There seems no logical reason why there should be any difference in the substantiality of the amount of 'affecting of' or being 'in' commerce to bring employment under either act."

For comparison, see Harris v. Hammond, 145 Fed. Rep. (2d) 333. Here the testimony showed that a majority of a corporation's sales were made to customers who entered its yard. It had a *limited* number of customers *in adjoining states*, to whom it made deliveries.

The higher court refused to hold this corporation within scope of the Fair Labor Standards Act because the testimony proved conclusively that less than 20% of its business was to customers outside the state.

Retail Establishment

Modern higher courts consistently hold that a "retail establishment" is a business making retail sales, in individual quantities for personal or household consumption. In other words, a "retail establishment" sells merchandise which is usually regarded as "consumers" goods. It is exempt from the Fair Labor Standards Act. See Walling v. Consumers Company, 149 Fed. (2d) 626.

Also, see Higgins v. Carr Bros. Company, 317 U. S. 572; 138 Me. 264. In that case the corporation bought its merchandise from sellers in other states, which was delivered by truck and rail, *unloaded into its warehouse*, and from there distributed to the retail trade.

The court held this employer exempt from the Fair Labor Standards Act.

Broadly Construed

According to a recent higher court gas, electric and like corporations must pay minimum wages specified by the Fair Labor Standards Act, if their employes are employed in *any* process or occupation *necessary* to the production of *any part or ingredient* of *any* articles for trade, commerce or transportation among the several states.

See the late case of Lewis v. Florida Power & Light Company, 154 Fed. (2d) 751. Here the testimony showed facts, as follows: A corporation is engaged in the generation of electrical energy at its plants in the state of Florida. Several *guards* hired to protect the corporation's property filed suit to recover compensation for overtime work, liquidated damages, attorney's fees, under the Fair Labor Standards Act.

During the trial the testimony showed that the corporation sells its services and electricity to many corporations engaged in interstate commerce, as telegraph companies, railroad companies, newspapers, radio stations, airports, bus lines, governmental agencies, etc., etc. Other important testimony was that the electric company does not own nor lease any real property outside of the state. it was argued that this latter fact resulted in the corporation not required to pay its guards minimum wages specified by the Fair Labor Standards Act because it transacted intrastate business exclusively within the state.

Nevertheless this Federal court held that the company employes engaged in production of electric energy "necessary" to the production of goods for interstate commerce. Hence its employes engaged in production of electric energy are entitled to wages specified by the Fair Labor Standards Act. This court said:

"The work of petitioner's (electric company's) employes has such a close and immediate tie with the process of production for commerce, . . . that the employes are to be regarded as engaged in an occupation 'necessary to the production of goods for commerce'."

It is important to know that this court refused to hold that the *guards* are entitled to wages specified by the Fair Labor Standards Act, saying:

"We hold that respondent (company) is engaged in the production of goods for commerce. That, of course, does not mean that its employes are covered by the Act. The applicability of the Act to them is dependent on the character of their work. . . ."

Thus, it is quite apparent that a gas corporation may be required to pay a majority of its employes minimum wages specified by the Fair Labor Standards Act, but certain employes *not necessary to production*, distribution or sale of gas may be exempt from the Act.

Also, see Callis, Vol. 325 United States Official Reports 578. Here the Supreme Court of the United States held that employes in an office building rented to tenants who manufacture, ship and distribute merchandise for shipment in interstate commerce are *not* within the scope of the Fair Labor Standards Act. This court held that the character of the work done by office building employes is not necessary to the production of merchandise for interstate commerce.

Brief Review

In De Waters v. Macklin Company, 167 Fed. (2d) 694, it was shown that an employer increased the hourly wage rates from sixty-five cents to ninety cents. In addition the employes were paid extra money or bonus depending upon the amount of work they turned out.

The higher court decided that the employes could *not* sue the employer and recover overtime compensation, because the employer paid one and one-half overtime figured on the total compensation received for straight time divided by the number of hours each employe worked.

In other words, the court held that in figuring the overtime the employer need not take into consideration money paid the employes based on "bonus" for the extra work they turned out.

In Atwater v. Gaylord, 184 Pac. (2d) 437, an employe named Atwater sued an employer Gaylord for $783 for overtime, $783 as liquidated damages, and attorney's fees of $300. Atwater proved that he was employed to make experiments. No goods or merchandise were sold or shipped because of these experiments.

The higher court decided that the Fair Labor Standards Act was *not* applicable to Atwater, and held that he could not recover any payment under the Fair Labor Standards Act for overtime.

While it is well established law that an executive is *not entitled* to wages, overtime, etc., specified by the Fair Labor Standards Act, yet one who does manual work, or acts as an inspector, is *not* an executive.

In Kerew v. Emerson Corporation, 76 Fed. Supp. 197, the testimony showed that one Kerew was employed as an associate engineer. Part of his job was to see that production at the plants was maintained at the proper standard required by the specifications. Also, he acted as an inspector. Kerew sued the employer to recover back wages, overtime, lawyer fees, etc., under the Fair Labor Standards Act.

The employer argued that Kerew could not recover compensation based on the Fair Labor Standards Act because he was an executive. The higher court refused to agree with this argument.

Under Control

Employes are not exempt from the Fair Labor Standards Act who perform contract work while under control of the employer.

For illustration, in Walling v. Rutherford Corporation, 156 Fed. (2d) 513, it was shown that an employer employed certain employes strictly on piece work payment basis. Also, the employment contract stated that the employes were "independent contractors."

The court decided that these employes are legal employes and within the scope of the Fair Labor Standards Act, because the company's manager would complain if the employes failed to perform their work efficiently. Thus, the court held that since the company's manager had "control" over the employes they were legal employes within scope of the Fair Labor Standards Act.

Fair Labor Standards Act

Modern higher courts consistently hold that employes engaged in *any part* of production or processing of goods for interstate shipment may recover wages specified by the Fair Labor Standards Act.

In E. C. Schroeder Company, Inc., v. Clark, 167 Fed. (2d) 739, it was shown that certain employes hauled products within the state to be used to produce or manufacture of goods for shipment to purchasers outside the state.

The higher court held that *all* these employes were entitled to wages specified by the Fair Labor Standards Act.

According to a recent higher court an employe *cannot* recover for overtime work under the Fair Labor Standards Act if his employer instructed him to *not* work overtime.

In Blakeley v. Fresno Company, Inc., 208 S. W. (2d) 902, the testimony showed that an employe was paid eighty-three and three-fourths cents per hour for a 40 hour week's work. After working several months the emplove sued his employer for several hundred dollars alleging that he had not been paid overtime for 1,218 hours.

The higher court refused to hold in favor of the employe because the testimony showed that *at the time* he was hired the employer gave him a time book and instructed him to not work more than 42 hours per week, or only 2 hours overtime in any one week.

Also, see Kappler v. Republic Corporation, D. C., 151 Fed. (2d) 543. Here an employe was instructed or advised by his employer *at the time of his employment* he was to work *no* overtime without the consent of the manager. The higher court held that the employe could not recover for overtime unless the manager had knowledge that he was working overtime.

And again see the important case of Thompson v. Loring Company, D. C., 50 F. Supp. 1. Here an employe was responsible for *full 24 hours* for the care of his employer's equipment. Also, he was subject when off duty to call at any hour if anything went wrong.

The higher court held that this employe could *not* receive overtime for the full 24 hours, but *only* for the hours actually worked over 40 hours each week.

C. P. Connally, Jr., Goes to Coast for Florence Stove

Charles P. Connally, Jr. has been appointed Western Division sales manager for Florence Stove Company and will establish headquarters at San Francisco, according to C. Fred Lucas, vice-president in charge of sales.

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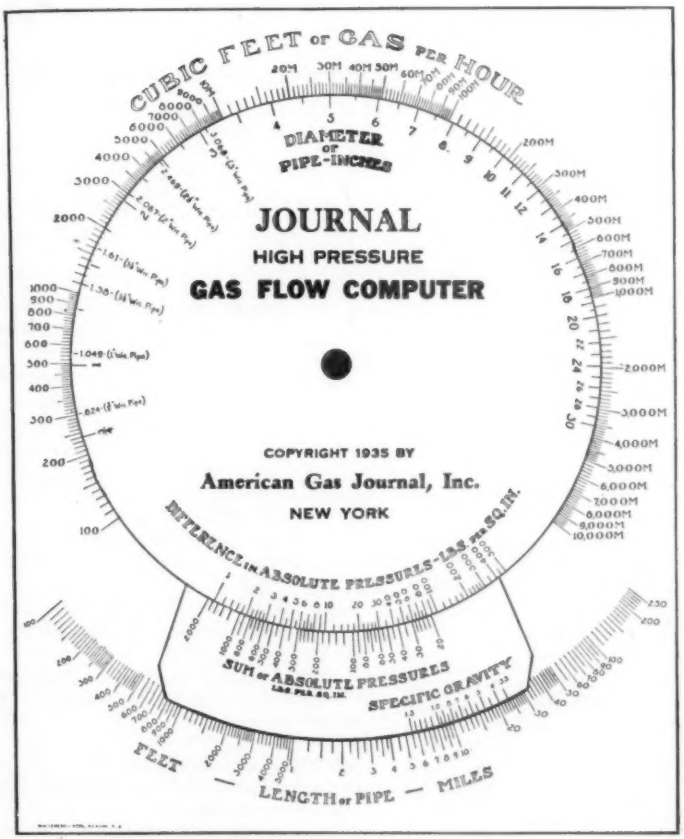

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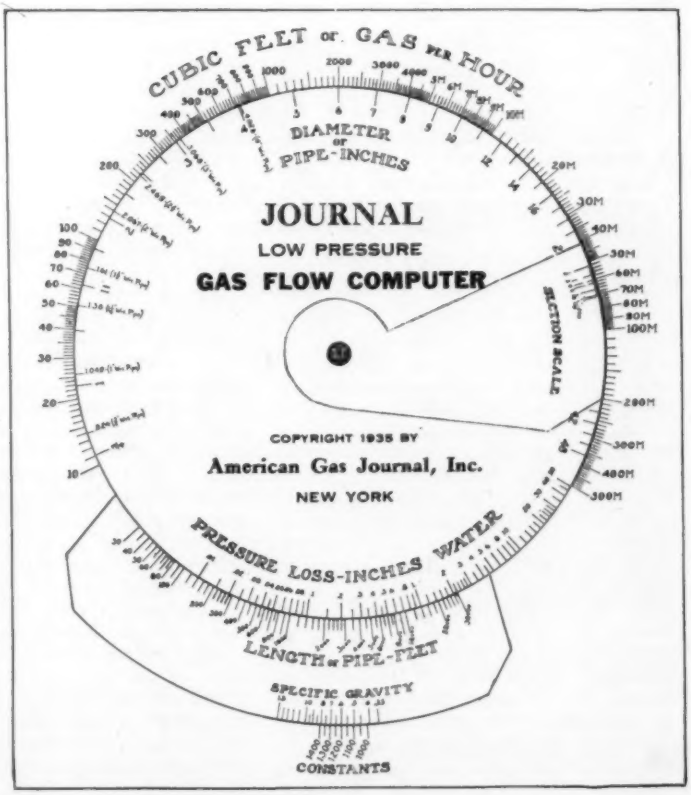

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News of the Gas Industry

Synthetics; Chemistry:—Features of Production Conference

THE growing interdependability of the gas utility industry, the chemical industry and the new processes developing in the manufacture of synthetic fuels was the broad theme of the annual production and chemical conference of the American Gas Association held in New York, May 23 through 25. Over six hundred chemists, engineers and operating men registered for the sessions.

H. C. Jones, Boston, chairman of AGA production committee, and F. E. Vandaveer, Cleveland, chairman of the chemical committee presided at the general sessions and directed the conference.

Hugh H. Cuthrell, Brooklyn, vigorous advocate of national standard Btu gas for all distributing utilities, said that the manufactured gas industry of the Atlantic seaboard," must revise its whole set of values to make ready for, and adjust to, the coming of natural gas."

Catalytic and thermal hydrocarbon cracking were envisioned by E. S. Pettyjohn of the Institute of Gas Technology, Chicago, as going beyond their original purpose of developing peak load production. This production, he said, may well become part of the base load operation of a gas plant, where part of the gas supply comes from a natural gas pipeline.

Kenneth H. Kingdon, Knolls Atomic Power Laboratory, Schenectady, told a chemical group that it would be a period of decades before any substantial part of the nation's power requirements are supplied by atomic energy.

Two synthetic fuel processes, Fischer-Tropsch and coal hydrogenation, were discussed in terms of potential gas and liquid fuel possibilities in a paper jointly authored by F. L. Symonds, P. W. Laughrey, L. C. Skinner and H. R. Batchelder, U. S. Bureau of Mines and E. E. Donath of the department of the Army. The paper, read by L. L. Newman, U. S. Bureau of Mines advised gas men that "the impact of a synthetic fuels development on the gas industry will be important and far reaching . . . gas production men, in searching for potential new sources of supply, must count in their plans the gas that will be obtained from synthetic fuels."

The accomplishments of gas production research under AGA auspices were summarized by F. J. Pfluke, Rochester, N. Y. Some tangible results to date have been: catalytic reforming and the Hall high Btu process for oil gas, developed to help meet peak production problems; practical information and techniques relating to the interchangeability of gases; a means for evaluating gas oils; construction of research equipment and the development of methods; a means of assessing the value of tar in water gas operation and stimulation of further independent research activity on the part of manufacturers of equipment.

Numerous other papers, panel discussions, and round table luncheon conferences added to the sum total of technical value that the conference afforded the gas industry. Carbonization and Coke, was the subject of two luncheon conferences with E. A. Manlove, Chicago, as chairman. Water gas operation was another, under the guidance of R. B. Paquette, Chicago. A. B. Lauderbaugh, Pittsburgh led a group interested in liquefied petroleum gas. High Btu gas was discussed in a luncheon presided over by W. H. Isaacs, Chicago. Chemistry in the gas industry was featured in a meeting with Louis Shnidman, Rochester as chairman and still another luncheon group took up the various phases of oxygen and its application to gas making. L. L. Newman, Washington, D. C. presided.

Many of the conference papers have been printed, and are available on request at the headquarters of the American Gas Association, New York.

Short Wave Communication for Mfrs. Light & Heat Co.

The use of short wave radio for emergency communications by The Manufacturers Light and Heat Company throughout Venango, Clarion, Forest and Mercer counties is now assured. The Federal Communications Commission has assigned the gas company call letters KGA 257. The new short wave sending and receiving radio station will operate with an output power of 250-watts.

The Federal Communications Commission also granted approval for the gas company to install and to operate short wave radio sending and receiving equipment on cars and trucks.

This use of frequency modulation short wave radio will improve the dispatching, control and operations activities of the gas company. Ultimately these fixed and mobile units will become part of a large short wave network to be operated by the seven associated gas companies in the Pittsburgh Group of The Columbia Gas System, Inc., in Pennsylvania, New York, Ohio, West Virginia and Maryland.

A. B. Lauderbaugh, chief gas engineer of the gas company is in general charge of the design and installation of this short wave radio system. David K. Ruth, communications engineer of the gas company will supervise the emergency radio system.

CONVENTION CALENDAR

June

13–14 *The Institution of Gas Engineers,* London, England.

16–20 *Canadian Gas Assn.* Annual Convention, Bigwin Inn, Lake of Bays, Ontario.

20–21 *New York-New Jersey Regional Gas Sales Conference,* Essex & Sussex Hotel, Spring Lake, New Jersey.

24–25 *Michigan Gas Assn.* Annual Convention, Grand Hotel, Mackinac Island, Mich.

September

7-9 *Pacific Coast Gas Assn.* Santa Barbara, Calif.

9 *New Jersey Gas Assn.,* Monmouth Hotel, Spring Lake, N. J.

16-17 *Maryland Utilities Assn.* Fall Conference, Virginia Beach, Va.

19–21 *National Butane - Propane Assn.,* St. Louis, Mo.

October

11–14 *American Standards Assn.* Annual Meeting, Waldorf-Astoria, New York.

13–14 *Texas Mid-Continent Oil & Gas Assn.,* Annual Meeting, Rice Hotel, Houston, Texas.

17–20 *American Gas Assn.,* Annual Convention, Chicago, Ill.

Western Society of Engineers Elects Dr. Egloff President

Gustav Egloff, petroleum technologist and director of research for the Universal Oil Products company, Chicago, has been elected to the presidency of the Western Society of Engineers.

Other officers elected were: H. P. Sedwick vice president of Public Service Company of Northern Illinois, first vice president; J. C. Witt, second vice president; and Donald N. Becker, treasurer; Ludwig Skog and L. F. Bernhard, trustees for three years.

The new officers will be installed at the Society's annual dinner, June 6.

Chapman Commercial Mgr. San Diego Gas & Elec. Co.

Walter F. Chapman, who has been associated with the San Diego Gas and Electric Company in various capacities since 1922 has been appointed Commercial Manager of the Company. Prior to his promotion, Chapman was serving as Superintendent of the Customer Extensions Department. He succeeds H. G. Dillin who was chosen Vice President in Charge of Sales.

L. P. Gas Association Holds Annual Convention in Chicago

Attracting upwards of 1,500 representatives of the LP-Gas industry from 45 States and several foreign countries, the annual convention and trade show of the Liquefied Petroleum Gas Association in Chicago's Palmer House May 9-11 shattered all previous attendance records. General and section sessions and the exhibit of new LP-Gas equipment and appliances in the exposition hall all drew extremely well throughout the conclave.

Speaking at Monday's general meeting, Howard D. Valentine, director of sales promotion, The Peoples Gas Light and Coke Co., Chicago, advanced the argument that LP-Gas men should place less emphasis on appliances in their sales promotion activities and stress instead the flexibility, controllability, adaptability and economy of gas service itself. Sharing the platform with Mr. Valentine was Frank Nugent, president, Gas Appliance Manufacturers Association, who urged the industry to launch a counter-offensive to offset electrical competition.

Analyzing the LP-Gas market potential at the same session, K. H. Koach, LPGA president, pointed out that approximately 10,000,000 homes in the United States still cooking and heating water with wood, coal or kerosene are prospects for LP-Gas service. Citing Bureau of Labor statistics which show that an addiitonal 1,000,000 homes per year will be added in the next three years and 500,000 per year will be required thereafter, Mr. Koach said a substantial portion of this market will adopt LP-Gas service. Some 3,000,000 existing homes probably need full replacement of appliances in use at the present time and at least 3,000,000 more require additional devices, he asserted.

At the general sessions on Wednesday, A. von Wening, vice-president and comptroller, A. O. Smith Corp., Milwaukee, emphasized the need for aggressive salesmanship to prevent the current setback in business activity from developing into a more serious recession. James Niederhauser, vice-president, Continental Can Co., New York City, spoke on "The U in Human Relations," and Ernest S. Allsopp, vice-president, Prudential Insurance Company of America, New York City, discussed "Financing by Purchase Lease."

Luncheon speakers at the convention were Richard Harkness, NBC news commentator; Clayton Rand, newspaper editor, columnist and humorist, and Roberto de la Rosa, Mexican "ambassador of good will." Talks on a variety of pertinent industry subjects and open forums characterized by lively discussions featured the section meetings on Tuesday.

Resolutions favoring a nation-wide advertising and publicity program for the LP-Gas industry were adopted by the Appliance Manufacturers, Equipment Manufacturers and Marketers sections. The Producers Section passed a resolution proposing a market survey to determine the feasibility of launching such a campaign.

Si G. Darling, president of Darlings, Inc., Pratt, Kans., was elected president of the association for the coming year.

Reigning as queens of the convention were the LP-Gas Twins, Miss Butane and Miss Propane. The identical and glamorous twins, Camille and Mildred Rago, wore blue-flame crowns. A banquet featuring "The Gas-Flame Gaieties," a scintillating variety show, brought the sessions to a close.

The LPGA will return to Chicago and the Palmer House for its 1950 convention, Howard D. White, executive vice-president, has announced.

Altenbern Heads Wisconsin Utilities Ass'n

Carl A. Altenbern, vice-president and secretary of the Wisconsin Southern Gas Co., Burlington, was elected by mail as president of the Wisconsin Utilities Association.

P. J. Imse C. A. Altenbern

Alfred Gruhl, assistant vice president, Wisconsin Electric Power Co., Milwaukee, was elected vice-president.

Paul J. Imse, secretary and treasurer of the Milwaukee Gas Light Co., was re-elected treasurer.

The officers were formally installed at an installation dinner in May.

Mr. Altenbern succeeds W. E. Schubert, of Appleton. The new president is a member of the National Society of Professional Engineers and is at present president of the southeast chapter of the Wisconsin Society of Professional Engineers.

Indiana Gas Ass'n Elects Hatley President

A. E. Hatley, sales manager of Central Indiana Gas Company, Muncie, was elected president of the Indiana Gas Association at its 39th annual convention at French Lick, April 28-29.

C. K. Graham, vice-president, Southern Indiana Gas & Electric Co., Evansville, was elected vice-president of the association; and Clarence W. Goris, Northern Indiana Public Service Company, Gary, was re-elected secretary-treasurer.

Hatley succeeds L. B. Schiesz, president of Indiana Gas & Water Company, Indianapolis.

New association directors are Fred W. Dopke, Indiana Gas & Water Co., Inc.; E. M. Hahn, Kokomo Gas Company; and E. G. Peabody, Citizens Gas & Coke Utility, Indianapolis.

Chamberlain Is President at Milwaukee

Glenn R. Chamberlain was elected president of the Milwaukee Gas Light Company on May 4, succeeding J. A. B. Lovett who resigned in April because of ill health.

Mr. Chamberlain was born in Grand Rapids in 1877, and after graduation from high school in 1897, he entered the employ of the Grand Rapids Gas Light Co., as a timekeeper. In 1905 he became president and general manager, and continued in that capacity until 1938 when the Grand Rapids company became part of Michigan Consolidated Gas.

Upon creation of Michigan Consolidated Gas, Mr. Chamberlain became First Vice-president, a director and member of the Executive Committee. He is also a director of the Michigan-Wisconsin Pipeline Co. and President and a director of the Austin Field Pipe Line Co.

On February 8, 1949, Mr. Chamberlain was elected Vice-president of American Light and Traction Co. and a director. He had been a director on two previous occasions. Also at that time he was elected Executive Vice-president of the Milwaukee Gas Light Co., and of the Milwaukee Solvay Coke Co.

Mr. Chamberlain has had extensive experience in changing utilities from manufactured gas to natural gas operations, a problem which reaches Milwaukee within the coming year. He directed the change-over of Muskegon in 1932 and in some of the Western cities of Michigan, including Grand Rapids in 1934. Again in 1936 he participated in the changeover in Detroit and Ann-Arbor.

He is a former President of the Michigan Gas Association and an organizer and Vice-president of the National Commercial Gas Association.

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Texas Eastern Hits Peak

Deliveries of natural gas through the Big Inch pipe line system averaged 474 million cu. ft. daily during March, and reached a peak of 514 million cubic feet on April 1, R. H. Hargrove, president of Texas Eastern Transmission Corp., reported to stockholders at the annual meeting of the company at Wilmington, Del., on April 26.

The lines continue to demonstrate their ability to perform as efficient carriers, he stated, pointing out that lost or unaccounted for gas for 1948 was less than 1% of the gas delivered. Despite the increased volume of gas handled during the first quarter of 1949, gas lost or unaccounted for still remained less than 1%.

Mr. Hargrove announced that construction has already begun on the company's $24,000,000 expansion program to increase capacity to 740 million cubic feet daily, as approved by the Federal Power Commission in March. The company anticipates that the program will be completed by the spring of 1950, although some increased delivery capacity will be available before the end of the year. This construction program, together with other work previously planned, will interfere to some extent with deliveries during the remainder of the year, he cautioned. This will be particularly true during the second and third quarters, when it will be difficult to maintain the high delivery average attained in March, he said.

All directors were re-elected.

Walsh Refractories Corp. Elects Crawford Pres.

Directors of Walsh Refractories Corp., St. Louis, promoted James L. Crawford, former Vice-President and General Manager to the Presidency of the concern. N.S.C. Walsh, retiring President, was named Honorary Board Chairman.

Crawford, with Walsh since 1932, entered the organization as its General Manager, later becoming Vice-President and General Manager and a member of the board of directors.

From 1923 to 1932 his assignment with the Laclede-Christy Co., St. Louis involved managerial and research activities. He resigned this position in 1932 to take up his executive duties with the Walsh Refractories Corp.

L. M. Klauber

Klauber and Holloway Are Promoted at San Diego

L. M. Klauber and A. E. Holloway were elected to the highest offices of the San Diego Gas & Electric Company on April 26. Mr. Klauber, former president, was elected Chairman of the Board; A. E. Holloway, President; and H. G. Dillin, Vice-president in charge of sales.

Hance Cleland, former board chairman, who will reach retirement age next October, requested that he be relieved of his position at this time. He will remain a member of the board.

Mr. Klauber went to work for the San Diego utility in 1911 as a salesman. He later became general superintendent, Vice-president and general manager, and then President, in 1946. He has been a director of the company since 1919 and a vice-president since 1923.

Mr. Holloway also started with the organization as a salesman. He was subsequently appointed manager of the New Business Department and Vice-president in charge of sales. He has been a director of the company since 1919 and a vice-president since 1932.

Mr. Dillin started with the company in 1924 as a draftsman. Later he became engineer in charge of rates, rules and regulations and commercial manager, a position he has held since last October.

A. E. Holloway

Underground Gasification

The April issue of Ohio State University's publication, *Engineering Experiment Station News*, contains an article on the underground gasification of coal, giving a review of major gas-producing processes and of American and foreign experiments.

M. H. Parkinson Becomes UGI Comptroller

M. H. Parkinson has been appointed comptroller of The United Gas Improvement Company and subsidiary companies.

Mr. Parkinson has had 25 years experience in the utility field, having been comptroller of Penn Central Light and Power Co., from 1925 to 1937 and with Pennsylvania Power & Light Co., from 1937 to 1947, during the last five years of which he was secretary and treasurer.

E. A. Brown Promoted

E. A. (Gene) Brown has been named new business manager of Union Gas System, Inc., Independence, Kansas.

He has been with the Union Gas group since 1934, and now will be in charge of public relations, customer services and advertising.

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Maryland Utilities Ass'n Elects R. R. Dunn

At the annual conference of the Maryland Utilities Association, held in Baltimore on April 21, R. Roy Dunn, Vice-president, Potomac Electric Power Co., of Washington, was elected President for the coming year to succeed Adrian Hughes, chief engineer, Baltimore Transit Co.

Other officers elected were:

Glenn T. Swisher, Potomac Edison Co., Frederick, First Vice-president; W. Griffin Morrel, C. & P. Telephone Co., Baltimore, Second Vice-president; J. Carl Fisher, Gas and Electric Company, Baltimore, Treasurer, and Raymond C. Brehaut, Washington Gas Light Co., Secretary.

Directors: J. Frank Blake, Jr., Charles P. Crane, George B. Daniel, E. C. Giddings, August B. Haneke, Adrian Hughes, Lewis Payne, Otis H. Ritenour and G. W. Spaulding.

Speakers at the conference were:

Herman L. Gruehn, Vice-president, Consolidated Gas Electric Light and Power Company of Baltimore, who spoke on "Raising Capital for Expansion."

Henry H. Startzman, assistant chief engineer, The Potomac Edison Company, who spoke on "Spending Capital for Expansion."

Wilbur VanSant, President, VanSant, Dugdale & Company Inc., who spoke on "Utilities in a Changing World."

Carroll B. Huntress, Vice-president, Republic Coal & Coke Company and Chairman of the National St. Lawrence Project Conference, made the address at the evening dinner meeting. He attacked Federal power projects as a "leaping form of socialism."

Transcontinental Line Gets Under Way

Construction of the 1,840-mile Transcontinental gas pipe line, which will deliver natural gas from the Gulf coast area to eastern seaboard cities, got under way May 23, when the first sections of 30-inch pipe were laid near Laurel, Miss.

The $190,000,000 project is scheduled for completion within two years. It will be capable of delivering 340,000 Mcf. gas per day, and its capacity may be increased to 505,000 Mcf. per day by the construction of additional compresser stations.

The 1949 building program announced by Transcontinental calls for 605 miles of main line construction between Eunice, Louisiana and Athens, Georgia. Next year the line will be extended northward to New York City and westward to the Rio Grande Valley of Texas.

The Transcontinental line will cross 76 rivers, including the Hudson and the Mississippi, numerous railroads and highways, and more than 5,000 separate tracts of land. Twelve major river crossings will be made this year, including three 20-inch lines under the Mississippi and suspension bridges to carry the line over the Atchafalaya in Louisiana and the Coosa in Alabama. More than 470,000 tons of finished steel pipe will be required to complete the line.

Kreuz Chosen Vice-Pres. of Milwaukee Coke

Henry Fink, president of American Light and Traction Co., has announced the appointment of Louis G. Kreuz as vice-president and general manager of Milwaukee Solvay Coke Co., a subsidiary of American Light.

Mr. Kreuz is a veteran of the gas and coke industry, and for 30 years has been in Detroit with the Michigan Consolidated Gas Company, another subsidiary of American Light.

Roland Paulin will succeed Mr. Kreuz as assistant manager of operations in the Detroit district. Paul E. Ewers will succeed Mr. Paulin as commercial office manager.

Mr. Paulin has been with the company for 23 years and has been commercial office manager for the past five years.

Mr. Ewers has been superintendent of customer relations since 1944. He is president of the Detroit Asociation of Credit Men and is Coordinator of Customers' Activities Committee for the American Gas Association.

Financial Outlook for Brooklyn Union Improved

At the annual meeting of The Brooklyn Union Gas Company held May 5, Clifford E. Paige, president and chairman of the board, told stockholders that earnings had improved appreciably during 1948. The favorable trend has continued through the first quarter of this year.

Mr. Paige attributed the improved position of the company primarily to rate relief obtained during 1948 and 1949. Since the first of this year there have been decreases in the cost of oil and coal.

"Future prospects appear excellent," he stated. Stockholders were told that the post-war expansion program, begun in 1945 has been practically completed. "Increased production capacity has resulted from this expansion program and we are hopeful that the restriction on gas heating may be relaxed to the extent of taking on 2,000 additional heating installations in 1949," the president reported.

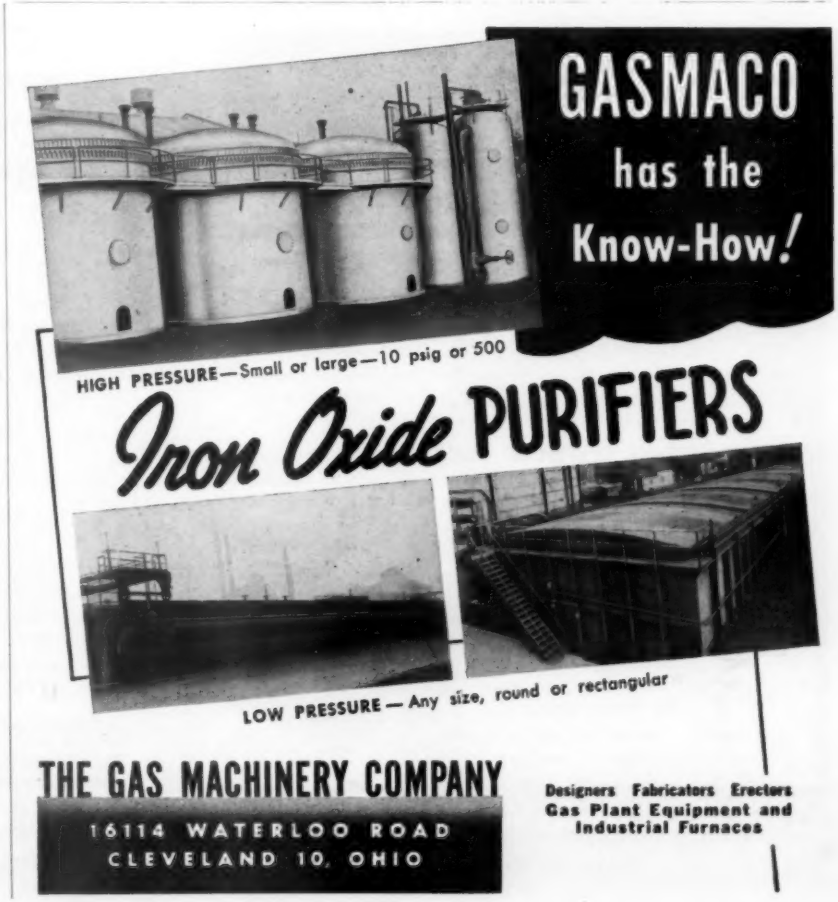
Gas appliance sales by the company in 1948 reached an all time high of $5,156,000.

J. W. Liebegott Retires

John W. Liebegott, assistant secretary and assistant treasurer of The Manufacturers Light and Heat Co. retired on May 1 after more than 46 years of accounting and auditing work for the company. For the past year he has been assistant secretary and assistant treasurer of each of the seven associated gas companies forming the Pittsburgh Group of the Columbia Gas System.

Miss G. M. Smith at Fall River

Geraldine M. Smith has joined the Fall River Gas Works Co., Fall River, Mass., to assist Mrs. Gladys V. Bramblett, director of home service. Miss Smith is a recent graduate of Iowa State College.



Tuttle Is Executive V-P of Michigan Consolidated

Henry Tuttle has been elected executive vice-president of Michigan Consolidated Gas Company. He has been vice-president and treasurer since 1945, and will be succeeded as treasurer by William A. Rhaesa, for the past four years assistant treasurer.

Mr. Tuttle's promotion will relieve President Henry Fink of many administrative details of Michigan Consolidated, a subsidiary of American Light and Traction Company, permitting Mr. Fink to devote more time to affairs of American Light and development of Michigan-Wisconsin Pipe Line Co., Milwaukee Gas Light Co., and Milwaukee Solvay Coke Co., which are also subsidiaries of American Light.

Mr. Tuttle has risen from the ranks, having been first employed in 1920 as service man in the shops department. He held positions of increasing responsibility and in 1940 was made vice-president and controller.

Mr. Rhaesa also started at the bottom, having joined Michigan Consolidated as a typist in 1927.

Texas Gas Undertakes Upping Underground Storage

Texas Gas Transmission Corp. has announced a program of developing underground storage facilities that eventually will multiply by thirteen times the amount of gas that can presently be withdrawn from storage for emergencies.

L. E. Ingham, vice-president, reports that the program calls for ultimate use of seven underground storage fields with a total capacity of 21,500,000,000 cu. ft., and a maximum daily deliverability from storage of 77,000,000 cu. ft. of gas.

Of these seven underground reservoirs, the only one currently in operation is the Oaktown Storage Field near Oaktown, Indiana. The Oaktown Field, which represents the company's initial experiment in storage of gas underground, has a capacity of 1,000,000,000 cu. ft. and a maximum daily deliverability of 6,000,000 cu. ft. It has performed creditably during the last few winters.

A. E. Strong Retires from Coast Counties

A. E. ("Al") Strong retired in May as Vice-president and regional manager of Coast Counties Gas and Electric Company after 42 years of continuous service.

His successor R. L. Hayden, is a Vice-president and director of Coast Counties, having served for the past two years as head of the company's Contra Costa region. He has been with the utility since 1930.

Mr. Strong will remain as a director of the company. He joined a predecessor company in 1907 and progressed through the organization, in 1929 becoming general superintendent of Coast Counties Gas and Electric Company. In 1945 he was elected to the board of directors and was designated regional manager of the company's Coast and Valley Region. In November of 1947 he was made a Vice-president.

Two Vermont Properties Turn to Propane-Air

North American Utility & Construction Corporation, of New York, has formed the Vermont Gas Corp., which purchased on April 21 the gas properties at Bennington and Brattleboro, Vermont, from the Central Vermont Public Service Corporation.

The water gas plants in each of the properties will be converted to propane-air. The Public Service Commission of Vermont has approved new rates which represent an increase of approximately 20%.

North American Utility & Construction Corp. also owns the Claremont Gas Light Company, Claremont, New Hampshire, which was converted to propane-air in 1946. The three gas properties will be operated together, under the direction of Samuel McLaughlin, manager at Claremont, and vice-president of the Vermont Gas Corp.

Druehl In New Post for Coast Counties

Hugo W. Druehl has been made manager, Organization Planning and Personnel, for Pacific Public Service Company and Coast Counties Gas and Electric Company.

Mr. Druehl has had extensive experience in business administration and organization and personnel work, both with the company and during wartime service.

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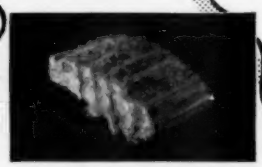

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James Woodall

Dana Paige

E. M. Lockwood

Sprague Meter Company Personnel Changes

E. M. Lockwood, former Sprague Meter Company representative in the Mid-west, has recently been promoted "Field Supervisor of Sales." Mr. Lockwood has served the company in various capacities since 1927.

James Woodall who has represented the company in the Southern States has been transferred to the Los Angeles branch as assistant to the Western Manager and will cover parts of the Pacific Coast and the Rocky Mountain States.

Dana Paige supersedes Mr. Woodall in the Southern territory.

Charles W. Merriam Joins Caloric Stove Corporation

Caloric Stove Corporation has named Charles W. Merriam, Jr., as a sales representative in eastern and southeastern Massachusetts, to augment the New England representation of Roger G. Stillman.

Mr. Merriam has wide technical experience in the gas utilities field. Since 1937, he was associated with Glenwood Range Company, Taunton, Mass., first as sales promotion manager, then as Boston district manager, and as sales director and advertising manager in the Boston district for the Glenwood company.

Mr. Merriam served in the United States Naval Reserve from July, 1942 to December, 1945, holding the rank of Lieutenant Commander. He was in the Mediterranean and Normandy campaigns.

He is the author of two books—"Domestic Gas Ranges," and "Household Gas Water Heating," has written many articles for gas magazines and is the author of the current series, "Domestic Gas Water Heating," appearing in the *American Gas Journal*.

Blaw-Knox Dehydration Plant for Argentine Pipe Line

Chemical Plants Division of Blaw-Knox Company has received a contract for the engineering and procurement of a dehydration plant to serve the Argentine Government's high pressure natural gas pipeline. (Route of this pipe line was mapped and described in this Journal, Jan. 1948, pg. 46.)

The dehydration plant will be erected at the Commodoro Rivadavia pumping station, located in southern Argentina, which pumps gas into the 1,200 mile line reaching industrial and domestic users in Buenos Aires. A dry type dehydration process will remove water vapor from 35 million cubic feet of gas per day at a minimum pressure of 1,000 pounds and will effect a minimum water vapor dew point depression of 70 degrees Fahrenheit. This will permit pumping the gas through its long travel without any water or hydrate formation.

The contractor, Agar Cross & Co., Ltd., of New York and Buenos Aires, is supplying all the equipment for the main pumping or compressor station, which also includes Blaw-Knox gas cleaners.

Changes at Dow Chemical

Leland I. Doan, newly elected President of The Dow Chemical Company, has announced the promotion of Donald Williams from general sales manager to director of sales, the latter position having been vacated by Mr. Doan when he stepped into the presidency on April 5, following the death of Dr. Willard H. Dow in an airplane crash March 31.

Mr. Williams in turn has announced the appointment of Donald K. Ballman, former assistant general sales manager, to fill the position of general sales manager, and of Dr. L. S. Roehm to the post of assistant general sales manager. Dr. Roehm has been in charge of Dow's Technical Service and Development Division and will continue also in this capacity.

Texas Gas Transmission Elects Elmer Treasurer

W. M. Elmer has been elected Treasurer of Texas Gas Transmission Corporation, W. T. Stevenson, executive vice president of the Company has announced.

Mr. Elmer has been associated with Texas Gas since June, 1947, when he was employed as Comptroller of Memphis Natural Gas Company. Following the merger of Memphis Natural and Kentucky Natural Gas with and into Texas Gas in April, 1948, Mr. Elmer was elected Comptroller of Texas Gas.

"Superior" Executive Going Abroad

Jay M. Grady, Vice-president of Superior Meter Co., Inc., Brooklyn, N. Y., who is convalescing from an operation, has left for an extended trip abroad to recuperate. While in Europe, Mr. Grady will visit the company's suppliers of heavy tinplate, and will also study recent developments in gas meter making.

Pacific Gas Corporation Elects New President

Harry W. Townsend, Vice-president of Pacific Gas Corporation, has been elected President by the firm's directors.

Harry W. Townsend

Mr. Townsend has been associated with the oil and gas industry since 1919 as a sales and marketing executive. As President of Pacific Gas Corporation, he will direct the firm's engineering, construction and marketing activities in the liquefied petroleum gas field in the United States and foreign countries.

FIRST SEE GRIFFITHS

FOR—
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New York-New Jersey Regional Gas Sales Conference

The vital need of intensive effort in sales promotion and in sales training if gas utilities and gas appliance manufacturers are to meet today's competitive conditions will be stressed at the New York-New Jersey Regional Gas Sales Conference to be held June 20 and 21, 1949, at the Essex and Sussex Hotel, Spring Lake Beach, N. J., under the sponsorship of the Residential Gas Section of the American Gas Association.

Walter G. McKie, assistant sales manager, Rochester Gas & Electric Corp., chairman of the Regional Conference, and his program committee comprised of George Kelly, Sales Department, Westchester Lighting Co.; Robert N. Laux, sales manager, Kings County Lighting Company; and W. D. Williams, assistant sales manager, Public Service Electric & Gas Co., have gathered an impressive list of speakers from within and from outside of the industry, to bring interesting developments in the sales field to the delegates.

Walter G. McKie will preside at the opening session on Monday morning. His speakers include Stanley C. Gorman, sales promotion director of the Water Heater Division of Gas Appliance Manufacturers Association, who will give an up-to-the-minute report on the progress of the Court of Flame Campaign, which is stimulating sales of automatic gas water heaters so successfully.

Southern Sales Executives Meet June 30 — July 1

The fourth annual Sales Executives' Conference of the Southern Gas Association will be held June 30 and July 1 at the Heidelberg Hotel, Jackson, Miss. There will be no prepared speeches, no minutes will be taken, and discussions will be informal, according to the announcement of M. H. North, chairman of the S. G. A. Sales Section.

Gas Water Heater Campaign

Stanley C. Gorman, sales promotion director of the current Court of Flame national gas water heater campaign which is now in the second quarter of its year-long program, sponsored by the Gas Appliance Manufacturers Association and the gas water heater manufacturers, has stated: "During the first three months of the sales drive, more than 360,000 Court of Flame tags were sold to manufacturers supporting the program. The sale of 1,500,000 gas water heaters is the goal of the national campaign.

"Results for the first quarter have greatly exceeded our expectations, and have reached a point we did not expect to attain until the half way mark," Mr. Gorman said.

A sound slide film "More for the Money," is being offered by GAMA and is now available for distribution.

It illustrates modern installation methods, including proper allocation of the gas water heater itself with relation to fixtures or outlets—short cuts in piping through the use of tubing—minimum runs—manifolds—hot water traps—proper venting, etc.

Copies of the film are available from the Gas Appliance Manufacturers Association, 60 East 42nd Street, New York, at $17.50 per copy.

Detroit-Michigan Stove Co. Holds Managers Meeting

For the first time since 1941, the Detroit-Michigan Stove Company held a four-day meeting of its divisional and district managers from all parts of the country and Mexico to show them a complete new line of domestic gas ranges "adapted to today's market."

Eleven new models of the Detroit Jewel and Garland domestic ranges put out by the Company were unveiled. The company declared the price situation has been met with "one fell swoop" to intrigue dealers and consumers into purchasing the new line which has up to 23 improvements to tempt the consumer.

John A. Fry, President, said the company had decided upon a low-price policy after the war and that this policy is "more important today than ever before." "We've got to consider every phase of today's buyer's market," he said. "This means a greater variety of product to meet individual household budgets and a more appealing and more economical product."

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The MIGHTY MIDGET reduces the cost of breaking asphalt and concrete to a minimum cost that is unequalled by other methods. Tamps backfill at an unbelievable pace; gives high density. All controls within operator's reach. Operates on 105 C.F.M. compressor.

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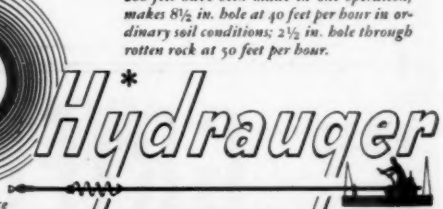

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The story of control for measuring and mixing both natural and manufactured gas in public utilities, industrial plants and municipalities is told in a new, well illustrated booklet by Cutler-Hammer, Inc., Milwaukee.

The booklet describes positive control to meet the problems of gas mixing, enriching, modifying, stabilizing, diluting and B.t.u. measurement.

Free copies of the booklet, 24 pages 8½ x 11 entitled "Where Experience Counts," can be obtained by writing Cutler-Hammer, Inc., 202 N. 12th Street, Milwaukee 1, Wisconsin.

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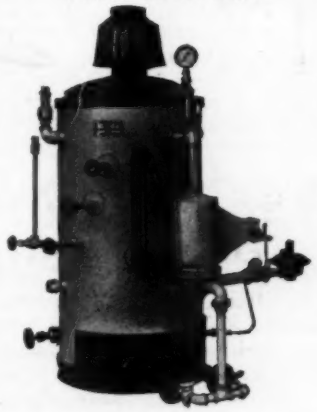

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The Reliable Shut-Off for Street Mains

Glenwood Range Co. Announces Expanded Operations

Malcolm Leach

Malcolm Leach, Glenwood Range vice-president and director of sales, has revealed the company's extensive expansion plans. These include widening present lines and adding new products in conjunction with merging Glenwood's sales and engineering facilities with those of the Estate Heatrola Division of Noma Electric Corporation of Hamilton, Ohio. Highlights of the new operating program as disclosed by Mr. Leach, are:

Continuation in business, now backed by the largest current assets in Glenwood's history and under the same ownership and management and with essentially the same sales personnel as heretofore.

Arthur Newman, who has been associated with Glenwood for 15 years, has been appointed sales manager. Mr. Newman will bring to this post an intimate knowledge of retail appliance selling as well as long experience as a Glenwood district representative.

Executive offices, showrooms, warehousing facilities, and service department will continue to be located in Taunton, Mass.

Available for shipment in July, four new popularly-priced Glenwood gas ranges. These ranges together with current models present a complete and competitively priced line of gas and utility-type ranges. All Glenwood gas and utility-type ranges and space heaters will be manufactured in the modern plant of the Estate-Heatrola Division of Noma Electric Corporation. New lines will feature a wider variety of models in the gas heating field, including three automatic gas space heaters.

Dual-oven ranges will be manufactured in Reading, Mass., from Glenwood patterns and dies and under rigid Glenwood control.

Claude M. Woodward, associated with Glenwood for 35 years, has been appointed parts and service manager to cooperate with distributors and dealers.

Glenwood will act as exclusive distributor in New England for the complete line of Estate ranges and heaters.

"The Company" Mr. Leach declared, "is now in the strongest position of its long history to build dealer sales and profits. This new sales and engineering association between Estate and Glenwood brings together two companies long famous as manufacturers of modern ranges. It brings to Glenwood a wider line than ever before, at prices to meet present day demands."

Seibold Made Sales Manager of Schutte & Koerting

Frederick L. Seibold has recently been appointed sales manager by Schutte and Koerting Company, Philadelphia, Pa.

Prior to his appointment Mr. Seibold served as sales engineer in the Philadelphia area. He has been with the company for 28 years.

Servel Cuts Prices

A reduction in factory prices of Servel gas refrigerators has been announced by Louis Ruthenburg, president of Servel. This reduction covers the entire line of current model refrigerators manufactured by the company except for the smallest model.

"These price adjustments," Mr. Ruthenburg said, "are not justified by current production costs. They are made in anticipation of lower material costs, increased production efficiency, reduced operating expenses and increased sales volume."

The price reductions are effective immediately.

"It is our belief," Mr. Ruthenburg said, "that these price adjustments will substantially activiate Servel sales and break down consumer reluctance to purchase now in the hope of lower prices."

White-Rodgers Appoints Two

White-Rodgers Electric Co,, St. Louis, Mo., has announced appointment of Arnold E. Petersen as manager of its northeastern division, with headquarters in New York, and of E. E. Harwood as manager of its Pittsburgh, Pa., district.

New High-Strength Pipe Wrap

A new, high-strength Fiberglas wrap for underground pipe lines is announced by Owens-Corning Fiberglas Corporation. Known as Coromat, the new wrap is a porous mat of glass fibers reinforced with long, continuous strands of glass yarns.

The yarns are made from filaments of glass designed to resist soil acids and electrolytic action. By incorporating the high-strength yarns in a multi-directional pattern, the tear strength of the basic Fiberglas pipe wrap has been increased 200 to 400 per cent.

The high tear strength of this pipe wrap permits application at high speeds without the time-consuming delays caused by breakage of the wrap. With breakage eliminated, 1000 or 1200-foot rolls can be used, doing away with frequent machine stoppages to add new rolls.

South Wind Division Advances H. W. Milner to Sales Mgr.

Appointment of H. W. Milner as sales manager of all gas-burning domestic heating equipment produced by the South Wind division of Stewart-Warner Corp. at Indianapolis has been announced by W. E. Judd, general sales manager of the division. He will direct all sales, distribution and promotional activities for "Saf-Aire" wall furnaces and "South Wind" wall or furnace-type zone heating systems.

Lincoln Electric Adds Three Directors

The Lincoln Electric Company, Cleveland, Ohio, has announced the election of three additional members to its board of directors. They are: G. F. Clipsham, assistant to the president, William Irrgang, director of plant engineering, and L. K. Stringham, director of welding development.

Cutler-Hammer Announces Move of Boston Office

Cutler-Hammer, Inc. of Milwaukee recently announced a change of address for its Boston District Sales office.

Headed by C. V. Topliffe, the new office is located at 784 Commonwealth Ave., Boston 15.

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